

THE LINK BETWEEN
THE PRACTITIONER
AND THE
LABORATORY

CAVENDISH FLETCHER
AND
HUGH McLEAN



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A Guide to the Practitioner in his
Relations with the Pathological Laboratory

BY
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PREFACE

THE objects of this book are—

Firstly, to give a list of those diseases, in the diagnosis, treatment, and prognosis of which the pathologist can be of assistance to the practitioner.

It must not, of course, be assumed that all the tests are absolutely diagnostic. Many will be of purely negative value, and others may simply weigh the balance of evidence in favour of one disease rather than another. Others, again, may be of aid in prognosis or in the regulation of therapeutic measures.

Secondly, to state briefly what material should be obtained for each test, how and when to obtain it, and how to send it to the laboratory.

Thirdly, to give the time which must elapse before a report from the pathologist can be expected. In this connection it should be clearly understood that the times given are *minimum* times, and, except in cases of great urgency, the pathologist should be allowed a considerable degree of latitude in this respect.

Fourthly, to give a brief résumé of vaccine and serum therapy.

We are aware that all the information in this book can be obtained from works on pathology, but our idea is that the practitioner may not have time to consult such works, and will be glad of a small pocket manual from which he can quickly refresh his memory as to the laboratory procedures available for any case to which he may be called.

This is not a work on pathology, but, roughly speaking, a mere index.

We trust that reference to this little book will enable the practitioner to send to the pathologist the right material in the right way.

Most of the instructions for the collection and transmission of the material for examination are copied from those compiled by Dr. G. L. Eastes, 6 Harley Street, London, W., and we are greatly indebted to him for permission to use these.

C. FLETCHER.

H. MCLEAN.

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A Link Between the Practitioner and the Laboratory

I

ALPHABETICAL LIST OF DISEASES, WITH DIRECTIONS FOR LABORATORY REQUIRE- MENTS

ABORTION (Miscarriage, stillbirth).

Tests. (1) Histological examination for products of conception.—Send pieces of tissue and blood-clot in the discharge (or curettings) from uterus, in a clean bottle containing rectified spirit 1 part, water 1 part. Very early abortion can often be detected in this way. Report in three days.

(2) Wassermann test of mother's blood.—Send blood (see p. 63). This test should be done in all cases of repeated miscarriage to exclude syphilis.

ABSCESSSES.—1. **Superficial** (Boils, carbuncles, cellulitis, ulcers).

Tests. (1) Bacteriological examination.—Send pus from a "ripe" boil, carbuncle, or incision into cellulitis, in a sterile tube or on a sterile swab. Also send two smears (see p. 63). Take great care not to use any antiseptic before or during collection. Report in two days or longer if bacteriology is complicated.

(2) Test for sugar in urine. Send about 4 ozs. of urine in a clean bottle—preferably a twenty-four hour or a mixed night and

morning specimen (see p. 70). This test is to exclude diabetes in cases of repeated boils. Report same day.

2. **Deep.** See SUPPURATION.

ACHOLURIC JAUNDICE. See CHOLÆMIA.

ACNE VULGARIS.

Test. Bacteriological investigation.—Send pus from pustules, comedones, and blackheads. The patient should attend the laboratory for this. If this is impossible, send pus from pustules on sterile swab. Collect blackheads as follows: Cleanse skin over several blackheads with ether. Squeeze out at least six blackheads, pick up with sterilized forceps, and place in a sterile test-tube with rubber bung. Moisten a piece of sterile wool in boiled water (but not wet enough to “run”), insert in tube to keep blackheads from drying up, and replace rubber bung. Dispatch *at once* to the laboratory. Autogenous vaccines can be prepared, and, if acne bacillus is present as well as staphylococcus, would take about ten days to prepare. Reports: Diagnosis by film in one day; by culture in five days.

ACUTE YELLOW ATROPHY OF LIVER.

Tests. (1) Blood count.—Send blood in special pipettes and films (see p. 59). Leucocytosis is present in this disease. Report in one day.

(2) Fragility of corpuscles.—This test must be done by the pathologist, and may help to distinguish from obstructive jaundice. Report in one day.

(3) For bile, leucine and tyrosine.—Send 8 ozs. of urine from a twenty-four hours sample (see p. 70). The presence of leucine and tyrosine is a strong indication of this disease. Report in two days.

(4) Total and ammonia nitrogen, acetone, diacetic acid, oxybutyric acid.—Send 8 ozs. of urine from a twenty-four hours collection (see

p. 70). Marked acidosis is present in this disease. Report in two days.

ADDISON'S DISEASE.

Tests. (1) Complete blood count.—Send blood in a special apparatus (see p. 59). This test is to exclude pernicious anæmia. Report in one day.

(2) Arneth count.—Send blood films (see p. 62). This test is of prognostic value. Report in one day.

(3) For bile.—Send not less than 1 oz. of urine in a clean bottle. This test is to exclude jaundice as cause of pigmentation. Report in one day.

(4) Microscopical.—Send fæces in a clean vessel. This test is to exclude jaundice as cause of pigmentation. Report in one day.

ADENOIDS.

Test. Histological, to exclude tubercle, growth, etc.—Send the actual adenoids in a bottle containing 50 per cent. spirit, if sent by post. Report in three days.

ALBUMINURIA.

Test. Microscopical and "routine."—Send about 4 ozs. of urine in a clean bottle from a mixed night and morning sample (see p. 70). Albuminuria may be due to many causes; therefore send specimen for this examination, and ask if any further test is indicated. Report in one day.

ALOPECIA AREATA, ETC.

Tests. (1) Microscopical and bacteriological.—Send hairs. Pull the short hairs out, taking care to get the *roots* out. Dispatch in pill-box. Alopecia areata can be diagnosed in this way, and ringworm excluded. Reports: Microscopical, in one day; bacteriological, in four days.

(2) Wassermann, to exclude syphilis.—Send blood (see p. 63).

ANCHYLOSTOMIASIS.

Tests. (1) Search for parasites and ova.—Send specimen of fæces—formed motion without purge. If this is negative, give a small dose of thymol followed by castor oil, and send motion to laboratory in clean jar. The test takes three days as a rule, because it is best to let the ova segment to help identification.

(2) Blood test for secondary anæmia.—Send blood in special apparatus and films (see pp. 59–62). Report in one day.

(3) Test for eosinophilia.—Send blood films (see p. 62). This test is included in (2) above. Report in one day.

ANÆMIA (Chlorosis, pernicious anæmia, leukæmia, splenic anæmia, secondary anæmia, aplastic anæmia, etc.).

Tests. (1) Complete blood count.—Send blood ; although it is better, whenever possible, to send patient to laboratory. If this is not possible, see p. 59 for special apparatus required in sending specimen. This *complete* count is *essential* for *primary* diagnosis, and it is useless to send a blood smear or clotted blood for anæmia. To control progress after diagnosis, only total red cell enumeration and hæmoglobin estimation may be necessary about once a month ; except in leukæmia, when leucocyte count is required as well. Report in one day.

(2) Coagulation time.—The pathologist must do this himself. This test is of prognostic value in pernicious anæmia. Report in one day.

ANEURISM.

Test. Wassermann, to exclude syphilis.—Send blood or blood serum (see p. 63).

ANGINA.—I. **Vincent's.**

Test. Examination for causal organisms. Send swab from throat. If the specimen has to travel any distance, spread two films from the

swab according to instructions on p. 78. Always send a swabbing for culture to exclude diphtheria, though Vincent's angina can be diagnosed by smears alone. The two diseases may coexist. Report in one day.

2. **Ludwig's.**—See directions as for abscesses (Cellulitis).

ANTHRAX.

Test. Bacteriological.—(a) Send fluid from malignant pustule. Prick pustule, and, if sufficient fluid, collect in a capillary pipette (see p. 69). If only small quantity, collect on a sterile swab. Be careful not to manipulate the pustule roughly, for fear of causing dissemination of the infection. (b) Send blood, obtained either by venupuncture as for Wassermann, or in Widal pipette (see p. 65). (c) Send 4 ozs. of urine in a sterile bottle. These two latter are only useful in later stages of the disease. (d) Send articles of clothing, in any package consistent with Post Office regulations (see p. 56). Shaving-brushes, fur coats, etc., have been known to convey the disease. Reports : As to film in one day, establishing a probability ; as to proof by culture and animal inoculation, in three days.

APPENDICITIS.

Tests. (1) Leucocyte count.—Send blood films and blood in special pipette (see pp. 61-2). This test is useful to indicate whether pus is present. In important cases the pathologist can attend and do the test every two hours, and note the fluctuations in the leucocytosis—indicating probable suppuration or not. Report in a few hours.

(2) Histological, for tubercle tumours, etc.—Send appendix after excision, in 50 per cent. spirit (Spr. Vin., Rect. water, Partes equales). Report in three to four days.

(3) Glycogen reaction.—Send blood films (see

p. 62). Positive reaction denotes a serious condition. Report the same day.

ARSENICAL POISONING.

Tests. Chemical analysis.—(a) Send 6 ozs. of urine, in a clean bottle, from mixed twenty-four hours sample (see p. 70). State whether qualitative examination only is required, or whether quantity is to be estimated. (b) Send fæces (the whole motion) in a clean jar. Report in two days.

ARTERIOSCLEROSIS (Atheroma).

Tests. (1) Wassermann.—Send blood or blood serum (see p. 63). This test is to exclude syphilis.

(2) Urine: microscopical and "routine" examination.—Send 4 ozs. of urine, in a clean bottle, from a twenty-four hours sample. (See p. 70). This test is to ascertain state of kidneys. Report in one day.

ARTHRITIS.

Tests. (1) For gonococci.—(a) Send fluid from joint, obtained by aspiration, in sterile bottle or tube. Transmit quickly. This test is for gonorrhœal arthritis in acute and subacute cases. (b) Send smears of urethral discharge (see p. 63). Report in one day.

(2) For tubercle bacilli.—Send fluid from joint (*vide supra*), to exclude tuberculous arthritis in chronic cases. Report in one day.

(3) For general bacteriological examination for septic arthritis.—Send fluid from joint (*vide supra*). Report in one to four days.

(4) Arneth count.—Send blood films (see p. 62). This test may be of prognostic value. Report in one day.

(5) Bacteriological examination of blood to exclude pyæmic condition. This test should be done by the pathologist himself. If this is impossible, see p. 66.

(6) Wassermann.—Send blood or blood serum

(see p. 63). This is to exclude syphilitic arthritis. See p. 66 as to report.

(7) For pyorrhœa.—See Pyorrhœa as to what to send and the method of sending. Arthritis may be secondary to pyorrhœa. Report in one day.

(8) Glycogen reaction.—Send blood films (see p. 62). This will help to distinguish between septic and rheumatic joints. Report in one day.

ASCITES.

Tests. (1) Microscopical and "routine" of urine, to indicate whether of renal origin.—Send 4 ozs. of urine, in a clean bottle, from a mixed night and morning sample (see p. 70). Report in one day.

(2) Microscopical and cytological.—Send ascitic fluid in a sterile bottle. Do not send the first $\frac{1}{2}$ oz. which comes away, as this may be blood-stained. This test may throw light on cause of ascites (*e.g.* tubercle, new growth, etc.). Report in one day unless cultures prove necessary.

(3) For tubercle bacilli or other organisms.—Same procedure as in Test 2.

(4) Chemical for pancreatic ferments in cases in which ruptured pancreatic cyst is suspected.—Send at least 1 oz. of ascitic fluid as free from blood as possible. Report in two days.

ASTHMA.

Tests. (1) Microscopical, for Kurschmann's spirals and Charcot-Leyden crystals, etc. — Send sputum in a clean bottle. Report in one day.

(2) Bacteriological.—Send sputum in a sterile bottle. Report in two to four days.

In both tests be sure that sputum is *coughed* up from lungs, and not merely from throat. See p. 72 for directions.

ATHEROMA. See ARTERIOSCLEROSIS.

BACILLURIA.

Test. Microscopical and bacteriological. Send urine. In female, a catheter specimen in sterilized bottle is essential. In male, catheter specimen is best ; but urine passed direct into sterile bottle, after cleansing meatus, is usually satisfactory. *Never* send a twenty-four hours sample for bacteriological examination, and always send to laboratory immediately after obtaining specimen. Report in one to three days.

BALANITIS.

Test. Bacteriological.—Send discharge on a sterile swab. Also send smears according to instructions on p. 63. The discharge may be gonorrhœal. Remember the possibility of hard sore under a phimosis ; but it is useless to send discharge for spirochætes. (See Chancre.) Report in one to two days.

BARLOW'S DISEASE. See SCURVY.

BILHARZIA.

Test. Search for ova in (1) Urine. Send urine when hæmorrhage occurs, and select portion at the *end* of micturition. 1 oz. is sufficient. Report in one day.

(2) Fæces. Send a small quantity in a clean vessel ; preferably when blood is present. Report in one day.

BLACKWATER FEVER.

Tests. (1) For malarial parasites.—Send blood ; smears are sufficient (see p. 63). Report in one day.

(2) Microscopical and for hæmoglobin in urine.—Send 4 ozs. in a clean bottle, from a mixed night and morning sample (see p. 70). Report in one day.

(3) Blood count.—Send blood in special pipettes and films (see p. 59). This test is to estimate degree of secondary anæmia. Report in one day.

BOILS. (*See* ABSCESSSES.)

BOTHRIOCEPHALUS LATUS.

Tests. (1) Search for parasites and ova. Send small quantity of fæces in a clean bottle. For search for head of worm send whole motion, after treatment. Report in one day.

(2) Blood count: hæmoglobin percentage, red cells, white cells, differential count.—This is best done by pathologist. If this is not possible, see p. 59. This test is for secondary anæmia and eosinophilia. Report in one day.

BOTULISM.

Test. Bacteriological examination of suspected food.—Send up any foods, especially preserved meats, which may be suspected. No real help in diagnosis of the case can be afforded by the pathologist, as this disease is due to the toxin, and not to actual infection by the *Bacillus botulinus*. Report in ten days.

BRIGHT'S DISEASE. *See* NEPHRITIS.

BRONCHITIS (Bronchial asthma, bronchial catarrh, bronchiectasis).

Tests. (1) For tubercle bacilli, to exclude tuberculosis.—Send sputum (see p. 72). Report in one day.

(2) Bacteriological examination.—Send sputum in sterile vessel (see p. 72). Report in two to four days.

(3) Microscopical, to show bronchial cells, etc.—Send sputum (see p. 72). Report in one day.

BRONCHOPNEUMONIA. (*See* PNEUMONIA.)

BUBO. (*See* CHANCER, SOFT.)

CACHEXIA.

Test. Complete blood count: hæmoglobin percentage, red corpuscles, white corpuscles, differential count.—This is best done by pathologist, but if this is not possible, see p. 59. This test is to exclude pernicious anæmia and to estimate degree of anæmia. Report in one day.

CALCULI, Urinary.

Tests. (1) Microscopical and "routine."—Send 4 ozs. of urine, in a clean bottle. It is best to send when there is *not* a large quantity of blood in the urine. Strong evidence (not proof) of renal calculus can often be obtained from urine. Report in one day.

(2) Chemical analysis of calculus.—Send calculus in a wooden or tin box so that it does not get damaged in transit. Report in one day.

Biliary (Gall-stones).

Test. Analysis of concretions passed per rectum or excised from gall-bladder.—Send concretions in fæces and/or calculi from gall-bladder, in a wooden or tin box, so as not to damage them in transit. Report in one day.

CANCER.

Tests. (1) Histological. (See Tumours.)

(2) Complete blood count: hæmoglobin percentage, red corpuscles, white corpuscles, differential count. This will show the degree of secondary anæmia (see p. 59). Report in one day.

CARBOLIC ACID POISONING (Carboluria).

Test. Chemical.—Send 6 ozs. of urine in a clean bottle. Report in two days.

CARBON MONOXIDE POISONING. (See GAS POISONING.)**CARBUNCLE. (See ABSCESSSES.)****CELLULITIS. (See ABSCESSSES.)****CEREBROSPINAL FEVER.**

Tests. (1) Bactériological and cytological.—Send cerebrospinal fluid in *sterile* tube or bottle kept at body temperature, and delivered within one hour to pathologist. Send as much as possible. It is best to call in the pathologist to attend the *first* lumbar puncture. The meningococcus dies out rapidly in the cold, and although this would not necessarily prevent a diagnosis by film in all cases, yet it would prevent the

identification of the type of meningococcus (which is made by agglutination tests on cultures). This is important, because special type sera can be used for treatment. Pending the identification of type, a polyvalent serum is administered. Reports: Test by film, the same day; differentiation of type, two to four days, usually three days.

(2) Naso-pharyngeal swabbing of cases and "contacts." By far the best method is to send "contacts" to the laboratory, but if this is impossible, send nasopharyngeal swabbings (see p. 78). It is, however, useless to send a swabbing if it will be more than half an hour in transit, as the coccus dies when cold.

CHANCRE, Hard. (See SYPHILIS.)

Soft.

Test. Bacteriological examination.—(a) Send scrapings from sore. Wipe away pus from surface of sore, and lightly rub the base of the ulcer with a sterile swab, and then make smears according to instructions on p. 63. This is for microscopical examination, but cultural examination is also desirable.¹ For this proceed as follows: Disinfect sore with Tr. Iodi. thoroughly. Apply dry dressing, and allow pus to accumulate beneath it for twenty-four hours. Then thoroughly soak sterile swab in pus, and deliver to the laboratory quickly. (b) Send pus from bubo. This can be sent in the same way if the bubo is already open. Otherwise do gland puncture and aspirate pus. If abundant, send in sterile tube; if scanty, make smears and send swab (see p. 63). Reports: As to film examination, in one day; cultural examination, in three to four days.

CHARCOT'S DISEASE.

Test. Wassermann. Send blood obtained by venipuncture (see p. 63).

CHLOROSIS. (See ANÆMIA.)

CHOLÆMIA and CHOLANGITIS. (*See also* JAUNDICE.)

Test. Fragility of corpuscles.—The pathologist should do this blood test himself.

CHOLERA.

Test. Bacteriological.—Send (a) fæces in a sterile bottle; (b) 1 pint of suspected drinking water in a sterile bottle. Result in three to four days.

CHOROIDITIS.

Test. Wassermann.—Send blood or blood serum obtained by venupuncture (see p. 63). Send at least 1 c.c. Always exclude syphilis in this disease.

CHYLURIA and LIPURIA.

Test. Microscopical and chemical.—Send 4 ozs. of urine in a clean bottle. Remember the possibility of "malingering"—*e.g.*, addition of milk to the urine. Report in one day.

CIRRHOSIS OF LIVER.

Tests. (1) Microscopical, and for bile.—Send 4 ozs. of urine in a clean bottle. Report in one day.

(2) Wassermann.—Send blood or blood serum obtained by venupuncture (see p. 63)—send at least 1 c.c. This test is to exclude syphilitic cirrhosis.

(3) For tubercle bacilli.—Send sputum in a clean bottle. This secondary factor should be excluded. Report in one day.

COLITIS, Mucous.

Test. Microscopical.—Send mucous cast passed per rectum, in a clean bottle. Report in one day.

Catarrhal.

Test. Microscopical.—Send fæces in a sterile bottle, to be examined for blood, pus, epithelial cells, etc. Report in one day.

Ulcerative.

Tests. (1) Microscopical. Send fæces—select a motion with blood or slough in it—to be examined for blood, pus, epithelial cells, etc. Report in one day.

(2) Bacteriological.—Send a small quantity

of fæces in a sterile vessel. This is for detection of infecting organism and exclusion of tubercle bacilli and dysentery. (See Dysentery, p. 24.) Report in two to four days.

Tuberculous.

Test. For tubercle bacilli and other germs.—Send sputum and fæces in sterile vessels. This is for detection of infecting organism and exclusion of tubercle bacilli and dysentery. (See Dysentery, p. 24.) Report for tubercle bacilli in one day.

COMA. (See also RENAL INSUFFICIENCY.)

Tests. (1) Chemical analysis for sugar, acetone, and diacetic acid. Also urea excretion (quantitative).—Send at least 4 ozs. of urine from a twenty-four hours collection (see p. 70). This is to exclude diabetes and uræmia. Report in one day.

(2) Cytological and bacteriological.—Send cerebrospinal fluid in a sterile bottle. This test will exclude cerebrospinal meningitis. Reports: In one day for cytological and film tests; in two to four days for cultures. (See Cerebrospinal Fever.)

(3) For urea in cerebrospinal fluid.—Send in a clean bottle. Urea is increased in uræmia. Report in one day.

(4) Wassermann. Send blood, blood serum, or cerebrospinal fluid—1 c.c. blood by venipuncture (see p. 63); cerebrospinal fluid in a sterile tube. This test is to exclude cerebral syphilis. See p. 66 as to report.

(5) Search for malarial parasites.—Send blood films (see p. 62). This test is to exclude cerebral malaria. Report in one day.

(6) Leucocyte count.—Send blood in special pipette, also blood films (see pp. 61-2). This test is to exclude cerebral abscess. Report in one day.

CONJUNCTIVITIS. (See OPTHALMIA.)

CYSTITIS.

Tests. (1) Microscopical.—Send 4 ozs. of urine, in a clean bottle, from mixed night and morning urine, to be examined for pus, bladder cells, etc. This will establish diagnosis, but not necessarily the cause. Report in one day.

(2) Bacteriological.—Send catheter specimen of urine if from female; in the male, it is sufficient for the urine to be passed direct into a sterile bottle after cleansing meatus. Report in two to three days.

CYSTS : Dermoid, Hydatid, etc. (See HYDATID CYST ;
also see p. 75.)

DIABETES : Mellitus.

Tests. (1) Chemical, for sugar (qualitative and quantitative), acetone, diacetic acid, and oxybutyric acid ; total nitrogen and ammonia nitrogen.—Send at least 4 ozs. of urine, in a clean bottle, from a twenty-four hours collection (see p. 70). Periodical quantitative tests for sugar to control dietetic treatment should be done. Report in one day.

(2) For hyperglycæmia.—The blood *must* be collected by the pathologist. This is useful to distinguish “renal” diabetes (in which there is simply a failure of the renal epithelium to prevent the excretion of glucose) from true diabetes. Report in one day.

Insipidus.

Test. “Routine” and microscopical, to exclude diabetes mellitus and to indicate Bright’s disease.—Send 4 ozs. of urine, in a clean bottle, from a twenty-four hours collection (see p. 70). Report in one day.

Phosphatic.

Test. Estimation of phosphates.—Send 4 ozs. of urine, in a clean bottle, from a twenty-four hours collection (see p. 70). Report in one day.

DIPHTHERIA

Test. Bacteriological for Klebs-Loeffler bacillus.—

Send swab from throat and from nose. Get a piece of membrane on swab, if possible ; if not, swab edge of lesion. It is most important that the swab should be taken *before* any antiseptic treatment is started, as the growth of the Klebs-Loeffler bacillus is arrested easily by a trace of antiseptic on the swab. Cultural examination is *necessary*. A forecast can be given by direct film within an hour ; this is sufficient indication for giving antitoxin, but does not constitute proof, and notification should be delayed until cultural report is received next day, unless clinical evidence warrants it in itself. A known case of diphtheria should not be freed from isolation until three consecutive negative swabs have been obtained, and here too it is important to leave off treatment twenty-four hours before taking swab. In the case of carriers not known to have had the disease, two consecutive negatives are sufficient. In the case of contacts one negative is sufficient. Report in one day.

DROPSY. (*See* ASCITES.)

DUODENAL ULCER.

Tests. (1) For blood.—Send small quantity of vomit in a clean vessel. Report in one day.

(2) For blood and occult blood.—Send small quantity of fæces in a clean vessel. The test for occult blood is an extremely delicate test, and is most useful in a negative sense as excluding a trace of blood. If the result is positive, all other sources of hæmorrhage must be excluded, and the patient must have been on a meat-free diet for at least three days for the test to have any significance. Report in one day.

(3) Complete blood count: hæmoglobin percentage, red corpuscles, white corpuscles, differential count.—This test is to estimate the secondary anæmia (see p. 59). Report in one day.

DYSENTERY : Bacillary.

Test. Bacteriological.—Send a small quantity of fæces in a *sterile* vessel. Select blood and mucus if present. It is important that the specimen be examined fresh, as fæces may go acid, and this reduces the vitality of the bacilli. If it is to be sent any distance, it is recommended that the specimen be mixed with an equal volume of 3 per cent. sodium hydrate. Report in four days.

Amœbic.

Test. Search for amœbæ.—Send a small quantity of fæces in a clean vessel. Amœbæ in the active state disappear after a few hours, hence specimen should reach pathologist *within two hours* if containing blood and mucus. If an old case, without blood or mucus, there is not such urgency, as the *cysts* can be recognized days after. Report in one day.

DYSPEPSIA.

Tests. (1) Chemical analysis.—Send gastric contents. A test meal should be given (see p. 77). This test is for hyperchlorhydria, hypochlorhydria, and gastric cancer. Report in one day.

(2) Microscopical examination of fæces for undigested food elements.—Send fæces in a clean vessel. Report in one day.

(3) Chemical analysis: reaction, fatty extract, bile pigment.—Send about 2 ozs. of fæces in a clean vessel. Report in three days. *v.i.*

(4) Urine analysis for total and ammonia nitrogen, acetone, diacetic acid, indican, skatol, etc.—Send a 6-oz. bottle of urine from a twenty-four hours collection (see p. 70). Report in two days.

For Tests 3 and 4 to be of service, the patient should be put on a standard diet (see p. 73) for at least three days previous to collecting samples.

(5) Cammidge reaction.—Send 4 ozs. of urine

in a clean bottle (twenty-four hours collection, see p. 70), for evidence of pancreatic disease. Report in two days.

(6) Diastase reaction.—(a) In urine—1 oz. is sufficient. State total quantity passed in twenty-four hours, but send sample passed before breakfast for test. This is a good test for pancreatic disease. (b) In blood. Send at least 5 c.c. of blood taken by venupuncture as for serological tests (see p. 63). Result in one day.

ECLAMPSIA.

Test. "Routine" and microscopical, and for acetone, diacetic acid, total and ammonia nitrogen.—Send urine. For full test at least 10 ozs. must be sent. If only for "routine" and microscopical, acetone, and diacetic acid, 4 ozs. are sufficient. It would be best to send a mixed night and morning sample (see p. 70) for the microscopical part, and a twenty-four hours sample (see p. 70) for the chemical part. Report in two days.

ECTOPIC GESTATION.

Test. Histological examination of (a) Fallopian tube, etc., removed at time of operation. Send according to directions on p. 75. (b) Send cast from uterus. This is sometimes passed in tubal pregnancy. Send as described on p. 75. Report in three days.

ELEPHANTIASIS.

Tests. (1) For filaria.—Send blood films (see p. 62). Blood should be taken at night, as it may be filaria nocturna. In the case of night workers the blood should be taken during the day. Report in one day.

(2) Wassermann.—Send at least 1 c.c. of blood or blood serum obtained by venupuncture (see p. 63). This test is to exclude syphilis.

EMPHYSEMA. (See BRONCHITIS.)

EMPYEMA. (See PLEURAL EFFUSION.)

ENDOCARDITIS.

Tests. (1) Bacteriological of blood.—The bacteriologist should attend and inoculate cultures at the bedside. If this is not possible, see p. 66. Report in two to four days.

(2) Complete blood count for secondary anæmia: hæmoglobin percentage, red corpuscles, white corpuscles, differential count.—Send blood in special pipettes and films (see p. 59). Report in one day.

ENDOMETRITIS.

Tests. (1) Histological.—Send curettings from uterus. For directions see p. 75 (*important*). This is for diagnosis and the exclusion of cancer. Report in three to four days.

(2) Bacteriological.—Send swabbing from uterus. Use a speculum and a long sterile swab. See that the swab does not touch vagina, but passes into cervical canal. Report in two to four days.

ENTERIC FEVER and PARATYPHOID FEVER.

Tests. (1) Widal.—Send blood, which is best taken by venupuncture (see p. 63), but a blood capsule containing not less than $\frac{1}{2}$ c.c. (9 minims) of blood will do (see p. 65). This test is useful from seventh day of the disease to six months after, but of no use in first week. Always have test done to *Bacillus typhosus*, *Bacillus paratyphosus A*, *Bacillus paratyphosus B*. Where patient has been inoculated within the previous year with typhoid and paratyphoid vaccines, one test may not be diagnostic, and three tests at three-day intervals would be necessary to establish diagnosis. Report in one day.

(2) Complement fixation.—Send 5 c.c. of blood drawn as for serological tests (see p. 63). A very sensitive test, but very complicated and not usually done. Report in two days.

(3) Bacteriological: search for the specific bacillus in (a) blood, (b) fæces, (c) urine.

(a) Blood. The bacteriologist should collect this, but if not possible, see p. 66. This test is useful from fifth to twenty-first day. Report in four to six days. (b) Send fæces—a small quantity in a sterile bottle. This test is useful from third day onwards. Report in two to six days. (c) Send urine—about 2 ozs. in a sterile bottle, preferably catheter specimen. Bacillus present after first week in 20 per cent. of cases at most. Hence this is not a very useful test for diagnosis, but should be done to see if the urine is free from infection in recovery. Report in two to six days.

(4) Diazo reaction.—Send urine—1 oz. is sufficient—in a clean bottle. This test is not specific and is not recommended. Report in one day.

EPIDIDYMITIS.

Tests. (1) For gonococcus and other organisms.—Send urethral discharge — two smears (see p. 63). Report in one day.

(2) Wassermann.—Send at least 1 c.c. of blood or blood serum obtained by venupuncture (see p. 63). This test is to exclude syphilis in chronic cases.

EPULIS.

Test. Histological.—Send excised tissue. Be sure that the piece excised includes the substance of tumour. Send in 50 per cent. spirit (see p. 75). This is to exclude sarcoma, etc. Report in three days.

ERYSIPELAS.

Test. Bacteriological.—Send fluid from a vesicle or serum from a scratch. This is best taken from near the spreading margin, in a capillary pipette (see p. 69) or on a swab. If there is no vesicle available, slightly scarify the spreading edge with a sterile vaccination knife and obtain serum on swab. Avoid antiseptics. Report in one to two days.

FAVUS.

Directions as for Ringworm.

FILARIASIS.

Test. Search for parasite.—Preferably get pathologist to examine fresh blood. If impossible, send blood smears (see p. 62), which must be made at night unless patient is a night worker. Report in one day.

FISTULA IN ANO.

Tests. (1) Bacteriological examination, including tubercle bacilli.—Send material from fistula on ordinary sterile swab (as used for diphtheria). Report in two to four days.

(2) Histological. — Send scrapings from sinus. Curette the sinus, and put pieces of tissue into 50 per cent. spirit (*important* ; see p. 75). This is to exclude malignant disease and tubercle. Report in two to four days.

(3) Examination of sputum for tubercle bacilli.—Send sputum in a clean bottle. See that sputum is coughed up, and not merely from throat (see p. 72). The fistula may be tuberculous and secondary to pulmonary tuberculosis. Report in one day.

FRAMBÆSIA. (See YAWS.)

FURUNCLE. (See ABSCESS, SUPERFICIAL.)

GALL-STONES. (See CALCULI.)

GANGRENE : Infective (*e.g.* gas gangrene).

Test. Bacteriological.—Send pus or swabbing from wound, on sterile swab, or pus in sterile tube, for *B. Welchii*, etc. Report in four days.

Dry and Moist Gangrene.

Test. Microscopical and routine of urine.—Send 4 ozs. in a clean bottle. This test is to exclude diabetes and renal disease. Report in one day.

GAS POISONING (Coal gas).

Test. Chemical and spectroscopical. Send about 5 c.c. of blood, mixed with an equal quantity of distilled water, in a clean vessel. Report in two days.

GASTRIC CATARRH, GASTRITIS, GASTRIC ULCER, GASTRIC CANCER.

Tests. (1) Chemical analysis for free and combined HCl, total acidity, acid salts, and lactic acid.—Send gastric contents after test meal (see p. 77). Examination of vomit is not a reliable guide. A test meal should always be given for this. Report in one day.

(2) Wolff and Junghan's test.—Same procedure as in Test 1.

(3) Microscopical for cells, blood, etc.—Same procedure as in Test 1.

(4) For occult blood.—Send fæces—a small quantity in a clean vessel. See remarks under Duodenal Ulcer. Report in one day.

GENERAL PARALYSIS OF THE INSANE.

Tests. (1) Wassermann.—(a) Send blood—at least 1 c.c.—obtained by venupuncture (see p. 63). (b) Send cerebrospinal fluid, in sterile tube.

(2) Cytological.—Send cerebrospinal fluid. About 5 c.c. of fluid is required, but it is better to send more. An increase of cells occurs in central nervous syphilis, and globulin is present with increase of total proteid. Report in one day.

(3) For globulin and total proteid.—See Test 2. Same directions as for Test 2. Report in two days.

(4) Colloidal gold test.—Same directions as for Test 2. Report in one day.

GLANDERS.

Test. Search for *B. mallei* by culture and animal inoculation.—(a) Send pus from abscesses, ulcers, etc., on sterile swab. (b) Send blood (see p. 66), but if possible bacteriologist should collect this himself. (c) Send nasal mucus on sterile swab. (d) Send gland juice obtained by gland puncture (see p. 69). Bacillus is present in blood in only small percentage of

cases. Reports: Culture, in four days; inoculation, in about twelve days.

GLEET. (*See GONORRHOEA.*)

GLOSSITIS.

Test. Wassermann.—Send blood or blood serum—at least 1 c.c.—obtained by venupuncture (see p. 63). To exclude syphilis.

GLYCOSURIA. (*See DIABETES.*)

GONORRHOEA.

Tests. (1) Detection of gonococcus.—Send (*a*) specimens of urethral discharge, vaginal discharge, or cervical discharge. Send at least two smears. In the male, smears can usually be made by spreading as described on p. 63; in the female, they usually have to be made from a swabbing (see p. 63). In the female obtain specimen from the urethra or cervix, and in the latter case use speculum and avoid vaginal contamination. Vaginal swabbings are only useful in the acute stage, after which the only chance of finding the organism is in carefully-taken cervical swabbings. In female children vaginal swabbing will suffice. Send (*b*) urine (from male only), passed into a sterile bottle. The first morning urine should be sent, or urine after prostatic massage. This is never so satisfactory as films from discharge. Report in one day.

(2) Cultures for gonococcus from discharge, for obtaining which the patient must attend laboratory. This is only necessary when auto-genous vaccine is required, or in cases having a medico-legal significance. Report in two days.

(3) Complement fixation.—Send blood or blood serum—at least 2 c.c.—obtained by venupuncture (see p. 63).

(4) Examination of pus from Bartolin's gland.—Send pus on sterile swab. Send also two smears (see p. 63). Suppuration in most cases is due to gonorrhœa. Report in one day.

GOUT.

Test. Chemical and microscopical (urea-uric acid ratio).—Send urine—6 ozs. in a clean bottle from a twenty-four hours collection (see p. 70). One test is of little value. Regular weekly estimations of urea and uric acid should be done over lengthy periods. Report in two days.

GUMMA.

Test. Wassermann.—Send blood or blood serum—at least 1 c.c.—obtained by venupuncture (see p. 63).

HÆMOPHILIA—HÆMORRHAGIC DIATHESIS.

Test. Coagulation time.—The pathologist should do this test himself. Coagulation time is much increased in this disease. Report the same day.

HEPATIC ABSCESS.

Tests. (1) Microscopical.—Send (a) fæces, in a clean bottle, for search for amœbic cysts. Report in one day. Send (b) pus from the abscess obtained by puncture or at operation, in a sterile bottle, for search for amœbic cysts and hydatid hooklets. Report in one day.

(2) Total and differential leucocyte count.—Send blood in special pipette and films (see p. 59). This is to test for leucocytosis in acute abscess, and eosinophilia in hydatid. Report in one day.

(3) Glycogen reaction.—Send blood films (see p. 62). This test is chiefly of prognostic value. Report in one day.

HIP DISEASE.

Tests. (1) Complete blood count: hæmoglobin, red corpuscles, white corpuscles, differential count.—Send blood in special pipettes and films (see pp. 59–62). This will test the degree of secondary anæmia in chronic, and of leucocytosis in acute, hip disease. Report in one day.

(2) Arneth count.—Send blood films (see p. 62). This test may be of prognostic value. Report in one day.

(3) Examination for tubercle bacilli or other bacteria.—Send pus obtained by aspiration or operation, in a sterile bottle or tube. Reports : Tubercle bacilli in one day ; other bacteria in two to four days.

HODGKIN'S DISEASE. (See LYMPHADENOMA.)

HYDRONEPHROSIS.

Test. Microscopical and "routine."—Send urine—4 ozs. in a clean bottle—from night and morning sample (see p. 70). Report in one day.

HYPERACIDITY and HYPERCHLORHYDRIA.

See directions as for Gastric Catarrh (p. 29).

IMPETIGO.

Test. Bacteriological.—Send pus, on sterile swab, from the pustules. Report in two to three days.

INDIGESTION. (See DYSPEPSIA.)

INFLUENZA.

Test. Bacteriological.—Send sputum in sterile bottle, or swabbing from throat on sterile swab, etc. Report in one to three days.

IODIDE POISONING.

Test. Chemical.—To detect iodine. Send urine—6 ozs. in a clean bottle—from a twenty-four hours sample (see p. 70). Report in two days.

IRITIS.

Test. Wassermann.—Send blood or blood serum—at least 1 c.c.—obtained by venupuncture (see p. 63). This test should always be done to exclude Syphilitic Iritis.

JAUNDICE.

Tests. (1) Microscopical and "routine." (2) For bile pigment. (3) Total and ammonia nitrogen estimation : acetone, diacetic acid, oxybutyric acid. (4) For leucin and tyrosine.—Send urine—4 ozs. for Nos. 1 and 2 ; 10 ozs. for all four tests—from a mixed twenty-four hours collection (see p. 70). No. 4 need only be done if acute yellow atrophy is suspected. Leucin and tyrosine are said not to occur in phosphorus

poisoning. Reports : Nos. 1 and 2 in one day ; Nos. 3 and 4 in two days.

(5) Diastase reaction.—Send urine—only “before-breakfast” specimen, but state total quantity in twenty-four hours. To exclude associated pancreatic disease. Report in one day.

(6) Microscopical and chemical.—Send fæces—a small quantity (about 2 ozs.)—in a clean bottle. This is for examination for pigments, estimation of fats, etc. Report in one day.

(7) Blood count : hæmoglobin percentage, red corpuscles, white corpuscles, differential count.—Send blood in special pipettes (see p. 59). Leucocytosis occurs in acute yellow atrophy. Report in one day.

(8) Fragility of corpuscles.—This can only be done by pathologist. Fragility is increased in obstructive jaundice, decreased in family cholæmia.

(9) Wassermann.—Send blood or blood serum (see p. 63). To exclude syphilis.

JAUNDICE, INFECTIVE. (*See WEIL'S DISEASE.*)
KALA-AZAR.

Tests. (1) For parasites (Leishmann-Donovan bodies).—Send (*a*) blood films. Spread two thin blood films according to instructions on p. 62, and two additional films about four times as thick. The films should be spread when the temperature is raised. Report in one day. (*b*) Juice from liver. Spleen puncture is considered to be a dangerous procedure, and therefore only liver puncture should be attempted, but even this is not without its dangers. Spread films of the juice on slides as for blood smears (see p. 62). Report in one day.

(2) For leucopenia.—Send blood in special pipette (see p. 61). Leucopenia is very marked in this disease. Report in one day.

LARDACEOUS DISEASE. (See AMYLOID DISEASE.)

LARYNGITIS, CHRONIC.

Tests. (1) For tubercle bacilli.—Send sputum in a clean bottle. Report in one day.

(2) Wassermann.—Send blood or bloodserum—at least 1 c.c.—obtained by venupuncture (see p. 63). To exclude syphilis.

(3) Arneth count.—This may be of prognostic value. Send blood smears (see p. 62). Report in one day.

LEAD POISONING.

Tests. (1) Chemical analysis.—Send (a) fæces; (b) urine. Send a large quantity, say the whole twenty-four hours' excretion. Lead is mostly excreted by the fæces; therefore the latter are preferable for examination. Report in two days.

(2) Complete blood count: hæmoglobin percentage, red corpuscles, white corpuscles, differential count.—Send blood in special pipettes and in films (see p. 59). This is not a diagnostic test, but it is well to know the degree of secondary anæmia. Report in one day.

LEPROSY.

Test. Search for the *B. lepræ*.—Send (a) serum from nodules. Scarify a nodule with a vaccination knife until serum is obtained. Spread at least two smears on slides, and allow to dry before sending. Spread as for blood films (see p. 62). Report in one day. Send (b) nasal mucus. Spread several smears. If no coryza exists, this can be produced by giving 60 grains of potassium iodide, but natural coryza is better. Report in one day. Send (c) gland juice. Same directions as for gland puncture in syphilis (see p. 69). Report in one day. Send (d) blood, in 1 per cent. sodium citrate solution. Same directions as for bacteriological blood tests (see p. 66). Send (e) excised nodule, in 2 per cent. formalin—for section

cutting and examination for the bacillus. Report in four days.

LEUCOPLAKIA.

Tests. (1) Wassermann.—Send blood or blood serum—at least 1 c.c.—obtained by venupuncture (see p. 63). To exclude syphilis.

(2) Histological.—Send tissue from tongue. Excise a patch or a piece from edge of ulcer, and send in 50 per cent. spirit, as for tumours (see p. 75). This is to exclude epithelioma. It is no use snipping off just the surface epithelium, but a fair depth of submucous tissue must be included. Report in two to four days.

LEUKÆMIA. (See ANÆMIA.)

LIVER ABSCESS. (See HEPATIC ABSCESS.)

LOCOMOTOR ATAXIA.

Same tests as for General Paralysis of the Insane.

LYMPHADENITIS (Enlarged glands).

Tests. (1) Histological examination for tubercle, lymphadenoma, and malignant disease.—Excise a gland and send in 50 per cent. spirit in a bottle (see p. 75). Report in two to four days.

(2) Complete blood count: hæmoglobin percentage, red corpuscles, white corpuscles, differential count.—Send blood in special pipettes and films (see p. 59). This is to exclude lymphatic leukæmia. There is no typical blood picture for Hodgkin's disease. Report in one day.

LYMPHADENOMA (Hodgkin's disease). (See LYMPHADENITIS.)

LYMPHATISM (Lymphatic state—status lymphaticus).

Test. Complete blood count: hæmoglobin percentage, red corpuscles, white corpuscles, differential count.—Send blood in special pipettes (see p. 59). This is for secondary anæmia and lymphocytosis. Report in one day.

MALARIA.

Test. Search for parasite and differential leucocyte

count.—Send blood films—two thin films according to directions on p. 62 ; also send two films much thicker. Spread these as follows : Put three or four drops of blood close together on middle of slide, and spread out only about 1 in. in length. Such thick films are long in drying, but do not pack until quite dry. It is most important that the patient should have had no quinine for at least forty-eight hours prior to the blood being taken for films. It is also important to take the blood at the proper time during the paroxysm. Suitable times are (1) at the commencement of an attack of fever ; (2) two to four hours after the rigor. Never take the blood during the height of the paroxysm. The best method is to take a specimen every hour from the commencement to six hours after the attack. Between the attacks of fever there is little or no chance of finding the parasite in the circulating blood. Films from spleen puncture yield the best results, but this procedure is difficult and not without its dangers. Report in one day.

MALTA FEVER. (Mediterranean fever).

Test. (1) Agglutination test.—Send blood (see directions for blood for serological tests, p. 63). Report in two days.

(2) Bacteriological.—Send blood (see p. 66). This is generally unnecessary, agglutination being sufficient. Report in seven to ten days.

MASTOIDITIS.

Tests. (1) Leucocyte count, total and differential.—Send blood in special pipette, also smears (see pp. 61-2). Leucocytosis may help in diagnosis. Report in one day.

(2) Bacteriological.—Send pus, on sterile swab, taken at time of operation or from discharge following same. Report in two to four days.

(3) For tubercle bacilli. Same procedure as in Test 2. Report in one day.

MEASLES.

Test. Leucocyte count.—Send blood in special pipette (see p. 61), also films (see p. 62). Leucopenia is present, and though not diagnostic may help to exclude certain other fevers. Report in one day.

MENINGITIS. (See also CEREBROSPINAL FEVER.)

Test. Cytological and bacteriological.—Send cerebrospinal fluid in a sterile bottle—5 c.c. at least. If cerebrospinal fever is suspected, it is better to have the pathologist in attendance unless arrangements can be made to keep the fluid warm in transit. Reports: Cytological in one day; bacteriological in two days.

MOLLUSCUM CONTAGIOSUM.

Test. Histological.—Send excised mollusc in 50 per cent. spirit (see p. 75). Sections will establish a diagnosis. Report in three days.

MULTIPLE MYELOMATA (Myelomatosis). (See also TUMOURS.)

Test. For Bence Jones protein.—Send urine—at least 2 ozs. of a mixed night and morning sample (see p. 70), or a twenty-four hours sample (see p. 70). This test gives conclusive evidence. Report in one day.

MUMPS.

Test. Leucocyte count.—Send blood in special pipette (see p. 61), and films (see p. 62). This does not establish diagnosis, but lymphocytosis may help to exclude certain other fevers. Report in one day.

MYELOMATOSIS. (See MULTIPLE MYELOMATA.)

NASAL CATARRH.

Test. Bacteriological for infecting organism.—Send nasal discharge. If profuse, this can be blown out into a small sterile bottle. If not sufficient for this, thoroughly soak a "diphtheria" swab

by passing well back through nares on either side. Report in two to four days.

NEPHRITIS. (*See also* RENAL INSUFFICIENCY.)

Tests. (1) "Routine" and microscopical.—Send urine—4 ozs. in a clean bottle—preferably from a mixed night and morning sample (see p. 70). It should be remembered that a positive diagnosis of chronic nephritis can seldom be made on a single examination of urine, and examinations should be repeated weekly for several weeks to establish diagnosis. It is the *constant* presence of casts and albumen that is important. Report in one day.

(2) Quantitative tests: albumen, urea-uric acid ratio, urea-phosphate ratio.—Send urine—6 ozs. in a clean bottle. A twenty-four hours sample is necessary, and when sending state total quantity of urine passed in twenty-four hours. (*See also* caution on p. 70.) Report in two days.

OPHTHALMIA (Conjunctivitis, ophthalmia neonatorum, spring catarrh, etc.).

Tests. (1) Bacteriological.—Send discharge from eye—two smears and a sterile swab soaked in discharge. Take specimen before applying treatment. This is for gonococcus, Morax bacillus, Koch Weeks' bacillus, etc. Reports: For film in one day; culture in two to four days.

(2) For eosinophilia.—Send discharge from eye—at least two smears (see p. 63). The presence of eosinophilia in the discharge indicates "spring catarrh." Report in one day.

ORCHITIS.

Directions as for Epididymitis.

OXALURIA.

Tests. (1) Microscopical.—Send urine—not less than 2 ozs.—in a clean bottle, preferably a mixed night and morning sample (see p. 70). Report in one day.

(2) Estimation of oxalic acid.—Send urine—

at least 1 pint of a twenty-four hours collection—in a clean bottle (see p. 70). This is a complicated and therefore expensive test. Report in two days.

PAGET'S DISEASE OF THE NIPPLE.

Test. Histological.—Send tissue. Excise a portion of the eczematous patch, getting the whole thickness of the skin. Send in 50 per cent. spirit (see p. 75). Histological appearances are generally diagnostic. Sections will often show whether definitely carcinomatous or not. Report in three days.

PANCREATIC DISEASE.

Tests. (1) Diastase reaction.—Send (a) urine—not less than 2 ozs.—in a clean bottle. Send sample from urine passed before breakfast, and *state* also total quantity passed in twenty-four hours. Report in one day. Send (b) blood; 5 c.c. of blood (or 2 c.c. of separated blood serum) must be sent. See directions as for serological tests (p. 63). Report in one day.

It is preferable to have both these tests done, but not absolutely necessary. Urine alone would be useful. This is a very good test for pancreatic disease.

(2) Cammidge reaction.—Send 4 ozs. of urine in a clean bottle, either a twenty-four hours sample or mixed night and morning urine. This test is often discredited, but we have found it useful as additional evidence with other tests. Report in two days.

(3) Microscopical of fæces.—Send fæces—a small quantity in a clean vessel. This alone is seldom diagnostic, but if fatty acid crystals and muscle fibres are in excess, it may help in diagnosis. Report in one day.

(4) Chemical, including analysis of fatty extract, and Schmidt's fermentation test.—Send fæces—about 2 ozs.—in a clean vessel. For

this the patient should be on standard diet (see p. 73). Report in three days.

(5) Wohlgemuth's amylase (diastase) test and trypsin index in (a) duodenal juice. This is obtained by aspiration through a duodenal tube. Send at least 5 c.c., but more is preferable. Do not add any diluent. (b) Fæces. A small quantity—say 2 ozs.—is sufficient. These tests are very reliable on duodenal juice, but not on fæces. Report same day.

(6) *Histological* examination of excised piece of pancreas obtained at operation. Place in 50 per cent. spirit (see p. 75).

PARASITES.

1. Intestinal.

Tests. (1) Search for parasites and parasitic ova.—Send fæces—about 2 ozs.—in a clean vessel. Report in two to three days.

(2) For eosinophilia.—Send blood films (see p. 62). Most parasites cause an eosinophilia, but not all. Report in one day.

2. Visceral.

Same procedure as for Test 2 above. Report in one day.

3. Skin.

For these skin parasites it is best to send the patient to the pathologist. In the case of "nits" (ova of *pediculus capitis*) the suspected hairs can be sent in a pill-box.

PEDICULI. (See above.)

PERITONITIS.

Tests. (1) Leucocyte count.—Send blood in a special pipette and blood films (see pp. 61-2). This test is to indicate suppuration. Report in one day.

(2) Microscopical and cytological, and for tubercle bacilli and other bacteria.—Send peritoneal fluid in a sterile bottle. This test will often help to diagnose between malignant

disease, tubercle, "dropsy," etc. Report in one day.

PERNICIOUS ANÆMIA. (See ANÆMIA.)

PHARYNGITIS.

Test. Bacteriological.—Send swabbing—an ordinary diphtheria swab will do. Report in two to four days.

PHLEBITIS. (See THROMBOSIS.)

PHOSPHORUS POISONING.

Directions as for Acute Yellow Atrophy.

PHTHISIS. (See TUBERCULOSIS.)

PLAGUE.

Test. Detection of bacillus in (a) pus. Send pus from bubo or from gland puncture or even excised gland, on a sterile swab or, if a whole gland, in a sterile tube. Report in three to seven days. (b) Sputum. Send in a sterile bottle. Report in three to seven days. (c) Blood. Culture media should be inoculated direct. Therefore get the pathologist to attend. If this is impossible, send as described on p. 66. Report in three to seven days. (d) Fluid from petechiæ. Send on sterile swab or in capillary pipette (see p. 69). Report in three to seven days. (e) Urine. Send catheter specimen in female, or specimen passed direct into a sterile bottle in male. Report in three to seven days.

PLEURAL EFFUSION.

Tests. (1) Cytological.—Send pleural fluid. It is best to send this in a sterile vessel, then bacteriological examination can be made also, if necessary. In collecting avoid first portion (if fluid is copious), as this is apt to contain blood. This test is for the diagnosis of pus, and may be an indication of tubercle or new growth. Report in one day.

(2) For tubercle bacilli.—Send (a) pleural fluid in a sterile bottle; (b) sputum in a clean bottle. Report in one day.

(3) Bacteriological.—Send pleural fluid in a sterile bottle. This is for cases of empyema. Report in two to four days.

(4) Arneth count.—Send blood films (see p. 62). This test is chiefly of prognostic value. Report in one day.

(5) Glycogen reaction.—Send blood films (see p. 62). This is useful in prognosis. Report in one day.

PNEUMONIA.

Tests. (1) Bacteriological examination for pneumococcus.—Send (a) sputum in a sterile bottle (see p. 72); (b) lung juice. Obtain by lung puncture, send in capillary pipette (see p. 69) or other small sterile vessel, and deliver at once. Do not send in syringe, as material dries up and jams piston. Vessel should be small, or specimen dries up. Reports: As to film in one day; as to cultures in two days.

(2) Glycogen reaction.—Send blood films (see p. 62). This may be of prognostic value. Report in one day.

(3) Coagulation time of blood—pathologist must do this at bedside. Very marked reduction of coagulation time occurs in pneumonia. Report same day.

(4) Estimation of urinary chlorides.—Send urine—1 oz. in a clean bottle—from a twenty-four hours collection or mixed night and morning specimens (see p. 70). Chlorides are much reduced or absent in pneumonia. Report in one day.

POLYURIA.

Same directions as for Nephritis and Diabetes.

PREGNANCY.

Abderhalden's test is the only laboratory test for pregnancy. This is complicated and expensive, and its reliability has been seriously questioned. If required, blood should be taken as for Wassermann (see p. 63), but no trace of

hæmolysis is allowable. Special care has to be taken in separating serum.

PSOAS ABSCESS.

Tests. (1) Bacteriological, especially for tubercle bacilli.—Send pus in a sterile bottle if the abscess be aspirated or opened.

(2) Arneth count.—Send blood films (see p. 62). This test may be of prognostic value. Report in one day.

PSORIASIS.

Test. Wassermann.—Send blood or blood serum—at least 1 c.c.—obtained by venupuncture. This is to exclude syphilis, but psoriasis tends to give a weak positive. A positive result is therefore not of much value. (See p. 63.)

PUERPERAL FEVER.

Test. Bacteriological of (a) swab from uterus. Take swab from interior of uterus, using a long swab and a speculum. Avoid contamination of swab by vaginal secretion, and by antiseptics. Report in one to three days. (b) Blood. This should be done by pathologist when temperature is up. If attendance of pathologist is impossible, proceed as described on p. 66. Use this test in septicæmic cases. Report in two to four days.

PURPURA.

Tests. (1) Complete blood count: hæmoglobin percentage, red corpuscles, white corpuscles, differential count (see pp. 59–62). This test is for secondary anæmia, and to exclude other anæmias as cause of purpura. Report in one day.

(2) Estimation of blood platelets.—The pathologist must do this himself. Report in one day.

PYÆMIA.

Tests. (1) Bacteriological of blood.—It is best to call in the pathologist, but see p. 66. Blood should be taken when temperature is over 102° F. Report in two to four days.

(2) Leucocyte count or complete blood count: hæmoglobin percentage, red corpuscles, white corpuscles, differential count.—Send blood in special pipettes and blood films (see pp. 59-62). A complete blood count is preferable, as there may be secondary anæmia as well as leucocytosis. Report in one day.

(3) Bacteriological of pus from abscesses. Send pus on sterile swab or, if copious, in sterile tube. Report in two to four days.

PYELITIS.

Tests. (1) Microscopical.—This will establish diagnosis, but not the cause. Send urine—not less than 2 ozs. of morning urine—in a sterile bottle. Report in one day.

(2) Bacteriological.—Send urine (see p. 71). This is for identification of causal organism. Reports: As to film in one day; cultures in two to four days.

PYORRHŒA.

Tests. (1) Bacteriological.—It is best to send patient to pathologist, as such small quantities of material quickly dry up on a swab. If patient cannot attend laboratory, send a smear from "pockets" around teeth (see p. 63), and if culture is required, send swab also. Reports: As to film in one day; cultures in two to four days.

(2) For amœbæ.—The patient must attend at laboratory for this. Report the same day. Amœbæ are found in practically all cases of pyorrhœa, but their importance is doubtful.

PYOSALPINX.

Tests. (1) For gonococcus.—Directions as for Gonorrhœa in Female.

(2) Leucocyte count.—Send blood in special pipette and films (see pp. 61-2). This may give evidence of pus, and help to decide operation in cases of acute salpingitis. Report in one day.

QUINSY.

Same directions as for Abscesses, Superficial.

RELAPSING FEVER.

Tests. (1) Search for parasite (*Spirochæta Obermeieri*).—Send blood films. These must be taken on the second or third day of febrile stage. At the crisis the spirochætes disappear from the peripheral circulation. Hence if missed during first attack, wait for next relapse, and take blood early. During a febrile interval, spleen puncture might reveal the parasite, but is a dangerous procedure. Report in one day.

(2) Lowenthal's reaction.—This is impracticable except in an epidemic, as it requires the mixing of the blood of two cases—one during the paroxysmal stage, and the other during the resting stage. For this test blood should be taken as for serological tests (see p. 63).

RENAL INSUFFICIENCY.

Tests. (1) Microscopical and "routine," also for urea-uric acid ratio, urea-phosphate ratio.—Send 6 ozs. of urine in a clean bottle. State total quantity in twenty-four hours, and send sample from this. (See note *re* twenty-four hours samples, p. 70.)

(2) Diastase reaction.—Send (*a*) blood—5 c.c. whole blood or 2 c.c. blood serum. Take as for Wassermann (see p. 63). Send (*b*) urine. State total quantity passed in twenty-four hours, but send sample of urine passed before breakfast; 1 oz. is sufficient, but it is best to send a larger quantity, say 4 ozs. The comparison of diastase contents of the blood and urine gives a good idea of the sufficiency of the kidneys, but it is useless to do the test on urine *only* for this purpose.

(3) The Ambard index.—Send twenty-four hours' urine; also 5 c.c. of blood. For this test the pathologist must take the blood. This index is a calculation based on the urea in the urine and the blood and the weight of the individual.

(4) Phenol-sulphone-phthaleïn test ("red test").—Send urine. About twenty minutes before injecting the drug the patient is given from 200 to 400 c.c. of water to drink. 1 c.c. of the phthaleïn solution containing 6 mgrms. is injected intramuscularly or subcutaneously. The drug can be bought in ampoules ready for use. Carefully note time of injection. After the injection the bladder is emptied with a catheter, and the catheter left in. The urine is allowed to drop from the catheter into a tube containing one drop of 25 per cent. sodium hydrate, and the time accurately noted when this first shows a pink tinge. This is normally about ten minutes after the injection. The catheter is then withdrawn, and the urine that is passed in the next hour collected, and subsequently that passed in the second hour. These two samples are labelled and forwarded to the pathologist.

(5) Salt retention.—Send at least 2 ozs. of urine from a twenty-four hours collection for each test. The patient must be put on a constant diet (that described on p. 73 will do, except that the quantity of *table salt* allowed with the meals *must be constant*) for several days, and the chlorides in the urine estimated for three successive days. On the fourth day give 10 grms. of *pure* NaCl by the mouth, and then send a twenty-four hours sample (see p. 70) of the urine for estimation of chlorides on the same day and the day following. It is necessary to accurately measure the quantity passed in the twenty-four hours for each test (*i.e.*, those preceding as well as following the additional NaCl). It is essential to use pure NaCl, and not ordinary table salt. Delayed excretion of the added salt is tested for at the laboratory.

(6) Lactose excretion.—Send urine. Give an

intravenous injection of 20 grms. of lactose in 200 c.c. distilled water, the solution having been Pasteurised for three hours for three successive days. Collect the urine three hours afterwards, and then every hour for the next six hours. Each specimen should be labelled as to time of collecting and sent direct to the laboratory. The test will show whether excretion of lactose is delayed. Report in one day.

(7) Estimation of cerebrospinal urea.—Send cerebrospinal fluid—at least 5 c.c.—in a clean bottle. Urea is increased in cerebrospinal fluid in renal insufficiency and uræmia. Report in one day.

(8) Estimation of non-proteid nitrogen in blood.—The pathologist must do this. The estimation of urea nitrogen is an even more complicated process, and we therefore recommend the estimation of non-proteid nitrogen. Report in two days.

RHINITIS and RHINOSCLEROMA.

Tests. (1) See Nasal Catarrh.

(2) Wassermann.—Send blood or blood serum—at least 1 c.c.—obtained by venupuncture. This is to exclude syphilis. (See p. 63.)

RINGWORM.

Test. Identification of fungus: (1) *Microsporon Audouini*; (2) *Trichophyton megalosporon ectothrix*; (3) *Trichophyton megalosporon endothrix*; (4) *Microsporon furfur*, etc.—Send hairs or scales.—Send the patient to the laboratory if possible, or pull out the short broken hairs from the patch and place in a small box (a pill-box will do). Do not wrap in paper, as the hairs are so apt to be lost in unfolding the paper. Obtain the scales as *large* as possible by scraping with the edge of a knife. Whenever possible obtain hairs rather than scales. The affected hairs may be distinguished by their becoming “frosted” after the application of a

little chloroform; this does not apply to healthy hairs or those infected by favus. Report in one day.

RODENT ULCER.

Test. Histological.—Send a portion of the ulcer in 50 per cent. spirit (see p. 75). When excising a piece of tissue for diagnosis, be careful to cut deep enough—at least the whole thickness of skin or mucous membrane. Report in two to four days.

RUPIA.

Test. Wassermann.—Send blood or blood serum—at least 1 c.c.—obtained by venupuncture (see p. 63).

SALPINGITIS.

Directions as for Pyosalpinx.

SCORBUTUS (Scurvy) and BARLOW'S DISEASE (Infantile Scurvy).

Tests. (1) Complete blood count: hæmoglobin percentage, red corpuscles, white corpuscles, differential count.—Send blood in special pipettes and blood films (see p. 59). Report in one day.

(2) Enumeration of blood platelets.—Pathologist must do this himself. Report in one day.

The blood count is not diagnostic, but the degree of secondary anæmia should be found. Blood platelets are diminished.

SCARLET FEVER.

Tests. (1) Total and differential leucocyte count.—Send blood in a special pipette and blood films (see pp. 61–2). Leucocytosis and eosinophilia may often help to distinguish from other fevers. Report in one day.

(2) "Routine" and microscopical examination of urine.—Send mixed night and morning specimen (see p. 70). The urine should always be examined for renal complication from second week onwards. Report in one day.

SEPTICÆMIA.

Tests. (1) Bacteriological examination of blood.—

The pathologist should do this if possible, but see p. 66. Always arrange to have the blood drawn when the temperature is up, and if possible over 102° F. Report in two to four days.

(2) Complete blood count : hæmoglobin percentage, red corpuscles, white corpuscles, differential count.—Send blood in special pipettes and blood films (see pp. 59–62). This is for secondary anæmia and leucocytosis. Report in one day.

SLEEPING SICKNESS. (*See* TRYPANOSOMIASIS.)

SMALLPOX. (*See* VARIOLA.)

SPERMATORRHŒA.

Test. Microscopical, for presence of spermatozoa.—Send urine or discharge from penis. Send smears on slide or, better, send discharge in a small clean bottle or capillary pipette according to quantity. The discharge often occurs during defæcation, hence should be collected at this time.

SPIROCHÆTOSIS ICTEROHÆMORRHAGICA. (*See* WEIL'S DISEASE.)

SPRING CATARRH. (*See* OPHTHALMIA.)

Send films of discharge from conjunctiva for eosinophilia.

STERILITY.

Test. For spermatozoa.—Send semen. This may be obtained by instructing the patient to induce semination into a clean bottle or test-tube or into a "sheath." Married men may be told to have connection wearing a sheath. Specimen should be delivered to the laboratory within two hours. In the case of non-productive marriages, always examine the husband's semen before submitting the wife to examination and treatment. Frequently the man is at fault. Report in one day.

STOMATITIS.

Test. Bacteriological.—Send swabbing of patch

or ulcer. An ordinary sterile diphtheria swab will do. Do not use antiseptics for twenty-four hours before taking swab. Report in one day.

SUPPURATION (Deep-seated).

Tests. (1) Total and differential leucocyte count.—Send blood in a special pipette and blood films (see pp. 61–2). Polymorphonuclear leucocytosis occurs when pus is present. Report in one day.

(2) Bacteriological.—During operation collect pus in a sterile tube. Report in two to four days.

(3) Glycogen reaction.—Send blood smears (see p. 62). This test may be of prognostic value. Report in one day.

SYCOSIS.

Same directions as for Impetigo.

SYNOVITIS. (*See* ARTHRITIS.)

SYPHILIS: 1. Primary.

Test. Search for spirochætes (*Treponema pallidum*).—For this it is best to send the patient to the pathologist, but if this is impossible—(a) send serum expressed from sore (see p. 69). Report the same day. (b) Send juice from enlarged groin glands, obtained by gland puncture (see p. 69). Report the same day.

These are the best tests in primary syphilis. The Wassermann test is only useful in *late* primary syphilis.

2. Secondary and Tertiary.

Test. Wassermann.—Send blood or blood serum—at least 1 c.c.—obtained by venupuncture (see p. 63). The Wassermann reaction is most helpful from the late primary stage onwards. Search for spirochætes in these stages is not likely to be successful.

3. Cerebrospinal Syphilis, Parasyphilis.

Directions as described under General Paralysis of the Insane.

TABES DORSALIS.

Same directions as for General Paralysis of the Insane.

TAPEWORM. (See PARASITES.)

TETANUS.

Test. Bacteriological examination (search for *B. tetani*).—Send pus or membranous material from wound, in a sterile bottle or on a “diphtheria” swab. Avoid contact with antiseptics. The detection of the tetanus organism is by no means easy, and practically always involves the inoculation of an animal. A probability can sometimes be established by examination of smears the same day. Report in about a week.

THREAD-WORMS. (See PARASITES.)

THROMBOSIS.

Test. Coagulation time of blood.—The pathologist must do this himself. Report the same day.

THRUSH.

Test. Examination for *Oidium albicans*.—Send swabbing from patches, on a sterile “diphtheria” swab. Diagnosis might be established by direct examination, but cultures are advisable to exclude diphtheria, and more reliable for detection of the oidia. Report in two days.

TINEA. (See RINGWORM.)

TONSILLITIS : Acute.

Same directions as for Diphtheria.

Chronic.

Tests. (1) For tubercle bacilli and other bacteria.—Send swabbing on a sterile “diphtheria” swab. Report in one day.

(2) Wassermann.—Send blood or blood serum—at least 1 c.c.—obtained by venupuncture (see p. 63). This is to exclude syphilis.

(3) Histological.—This is to exclude tubercle and new growth. Send enucleated or excised tonsil in 50 per cent. spirit (see p. 75), unless animal inoculation for tubercle bacilli is required, in which case send in sterile saline. Report in three days.

TRICHINA SPIRALIS—TRICHINIASIS.

Tests. (1) Search for adult male worms.—Send

fæces in a clean bottle. These worms are only found in the diarrhœic stage of the disease. Report in one day.

(2) Search for larvæ.—Send blood—about 10 c.c.—obtained by venupuncture (see p. 63). The blood should be drawn direct into a test-tube containing 3 per cent. acetic acid (at least 15 c.c.). It is better for the pathologist to do this. Report in one day.

(3) Search for embryos in muscle.—Send an excised piece of suspected muscle—deltoid, biceps, pectoral, etc.—in normal salt solution. Report in one day.

(4) Examination for eosinophilia. — Send blood films (see p. 62). This is a very marked feature, and therefore useful in diagnosis. Report in one day.

TROPICAL ULCER : DELHI SORE, ALEPPO BOIL, ETC.

Test. Examination for parasite.—Send juice from ulcer—in capillary tubes if sufficiently abundant ; if not, in smears (see p. 62). The juice is best taken from the marginal indurated tissues, as described under “ Search for Spirochætes ” (see p. 69). Report in one day.

TRYPANOSOMIASIS.

Test. Examination for trypanosomes.—(1) Send blood : (a) Smears (see p. 62) ; (b) about 10 c.c. of fresh blood obtained by venupuncture (see p. 63), collected into a sterile test-tube containing 10 c.c. of 1 per cent. potassium citrate solution. The tube should be well corked with a rubber bung, and sent to the pathologist at once. Try method (a) first ; if negative, try method (b), and if possible get the pathologist to take the blood himself. If still negative, a little of the suspected blood should be inoculated into a suitable animal. The pathologist must do this.

(2) Send gland juice obtained by gland punc-

ture (see directions as for examination for spirochætes, p. 69). Also send smears on slides.

(3) Send cerebrospinal fluid—not less than 10 c.c.—in a sterile bottle or test-tube. This is only useful late in the disease.

TUBAL PREGNANCY. (See ECTOPIC GESTATION.)

TUBERCULOSIS.

Tests. (1) Examination for tubercle bacilli: (a) By direct film; (b) by antiformin or other sedimentation method; (c) by cultivation; (d) by animal inoculation.—The following is a list of what to send according to the part of the body affected: Sputum, urine, pus, or fæces; cerebrospinal fluid, pleural fluid, ascitic fluid, pericardial fluid, or synovial fluid; swabbings from ulcers, sinuses, and wounds, discharges, tissues obtained by operation or curettings, cow's milk or other suspected foods. These must be sent in sterile vessels, avoiding contact with antiseptics. Do not forget to examine the fæces in children in whom pulmonary tuberculosis is suspected, sputum being seldom available. In all specimens examination by direct film is the usual method. Should this prove negative, one of the sedimentation methods may be tried, and if still negative, animal inoculation is the surest test of all. In general, cultural examination serves no useful purpose except to distinguish between human and bovine types. Reports: (a) and (b) in one day; (c) in about two weeks; (d) in three weeks.

(2) Histological. — Send tissue — enlarged gland, granulation tissue, etc.—in 50 per cent. spirit (see p. 75), unless a direct film for tubercle bacilli or animal inoculation as above is also required, when the specimen to be examined should be sent wrapped in lint soaked in sterile saline solution and put in a clean bottle. Report in three days.

(3) Arneth count.—Send blood smears (see

p. 62). This is often a useful prognostic test. Report in one day.

(4) Tuberculin reaction: cutaneous, sub-cutaneous, ophthalmic, etc.—These are clinical tests, and should be carried out *in toto* by the practitioner himself, full directions being usually supplied with the various tuberculins.

TYPHOID FEVER. (See ENTERIC FEVER.)

TYPHUS FEVER.

There is only one laboratory test of any positive value in Typhus Fever, namely, the Weil-Felix reaction. For this, send blood as for Widal test (see p. 63). Report same day.

Other tests will be for exclusion of other fevers, such as Enteric, *q.v.*

URÆMIA.

The same tests applicable as for Renal Insufficiency.

URETHRITIS.

Test. Bacteriological.—Send urethral discharge—in smears (see p. 63) and on a sterile swab. (See also Gonorrhœa.) Report in two to four days.

URIC ACID DIATHESIS. (See GOUT.)

VARICELLA (Chicken-pox).

Test. Total and differential leucocyte count.—Send blood in a special pipette (see p. 61), and blood films (see p. 62). This test is only of negative value, but the absence of blood changes may help to distinguish from certain other fevers, especially smallpox. Report in one day.

VARIOLA.

Same test and procedure as for Varicella. Marked absolute lymphocytosis is present in smallpox, and will help to distinguish from varicella. Report in one day.

VIRILITY.

Test. Examination for motile spermatozoa, as described under Sterility.

WEIL'S DISEASE.

Test. Animal inoculation to detect the *Spirochæta*

icterohæmorrhagica.—If possible, the blood should be collected by the pathologist, but about 5 c.c. (obtained by venupuncture, see p. 66), taken direct into 1 per cent. sodium citrate solution and sent to the pathologist quickly, would do. Report in seven days.

WHOOPING-COUGH.

Tests. (1) Bacteriological for "Bordet-Gengou" bacillus.—Send sputum in a sterile bottle—sputum obtained during a coughing paroxysm as early as possible in the disease. A film examination may establish a probability the same day, but cultivation and complement fixation are necessary for proof. Report in four days.

(2) Total and differential leucocyte count.—Send blood in a special pipette (see p. 61), and blood films (see p. 62). Absolute lymphocytosis is very marked in this disease, and will often help to distinguish from other fevers. Report in one day.

YAWS.

Tests. (1) Examination for *Treponema pallidulum* (*Spirochæta pertenuis*).—Send fluid from papules. Scarify papule with sterile vaccination knife, and squeeze out serum; collect in a capillary pipette and also make films (see pp. 69 and 62). Report in one day.

(2) Wassermann.—Send blood or blood serum—at least 1 c.c.—obtained by venupuncture (see p. 63). The serum sometimes gives a positive Wassermann reaction. Report the same day.

II

POSTAL DIRECTIONS FOR SPECIMENS SENT FOR ANALYSIS

THE postal authorities make stringent regulations as to the transmission of pathological material by post. Most laboratories supply apparatus in conformity with these rules. The following is an extract from the Post Office Guide :

“ Deleterious liquids or substances, though otherwise prohibited from transmission by post, may be sent for medical examination or analysis by a qualified medical practitioner or qualified veterinary surgeon to a laboratory or institute, public or private, or to a medical practitioner or veterinary surgeon within the United Kingdom, by ordinary LETTER POST, under the following conditions :

“ Any such liquid or substance must be enclosed in a receptacle hermetically sealed, which receptacle must itself be placed in a strong wooden, leather, or metal case in such a way that it cannot shift about, and with a sufficient quantity of some absorbent material (such as sawdust or cotton-wool) so packed about the receptacle as absolutely to prevent any possible leakage from the package in the event of damage to the receptacle.

“ The packet so made up must be conspicuously marked ‘ Fragile, with Care,’ and bear the words ‘ Pathological Specimen,’ and also the signature and address of the medical practitioner or veterinary surgeon who sends it. THE PACKET MUST ON NO ACCOUNT BE SENT BY PARCEL POST. Any packet found in the post not packed and marked as directed will be at once stopped and destroyed with all its wrappings and enclosures.

“ Any person who sends by post a deleterious liquid or substance for medical examination or analysis otherwise than as provided by these regulations is liable to prosecution.”

III

LIST OF APPARATUS REQUIRED BY THE MEDICAL PRACTITIONER FOR COLLECTING AND TRANSMITTING SPECIMENS

THE following will enable the practitioner to meet any pathological emergency. More than one of each should be kept, of course. Most laboratories supply these, and most of them are usually replaceable, so that only an initial outlay is involved.

1. *Sterilized Diphtheria Swabs*.—These are suitable for transmission of throat and nose swabs, pus from wounds, etc.
2. *Sterilized long swabs*, like diphtheria swabs, only longer. Suitable for swabbings from cervix uteri.
3. *Sterilized small wide-mouthed bottles* with rubber bungs, packed in tins ready for post (see p. 56). These are suitable for sputum, cerebrospinal fluid, synovial fluid, etc., pus if abundant, fæces, portions of tumours, etc.
4. *Sterilized large bottles* with rubber bungs (6 ozs.), in tins, suitable for urine, pleural fluids, etc.
5. *Boxes of slides* for pus, blood films, etc.
6. *Wassermann outfit* (see p. 64).
7. *Sterilized blood capsules* (see p. 65) for Widal's, etc., in case venupuncture is not possible.
8. *Sterilized capillary pipettes*, in metal case. Suitable for spirochæte tests, etc., but *not* for Widal's and other serological tests (see p. 69).
9. *Sterilized test-tubes*, with rubber bungs, in wood-block cases, suitable for cerebrospinal fluid, and many other obvious purposes.
10. *Special sterilized pots for fæces*, with spoon attached to corks, are very useful, but not absolutely essential.
11. *Hæmacytometer pipettes* (see p. 61).—These are generally loaned for the purpose by the laboratory, but it is preferable to have your own set.

IV

GENERAL DIRECTIONS FOR SENDING SPECIMENS TO THE LABORATORY

ALWAYS enclose with the specimen *at least* the following particulars :

1. *Doctor's name, address, and telephone number.*
2. *Patient's name, initials, or other identification mark.* (Without this, reference to past examinations is impossible under any system, and such reference may at any time be required.)

3. *Age and sex of patient.*

4. *Nature of specimen*—e.g., sputum, urine (catheter specimen, twenty-four hours sample, etc.), etc.

5. *Nature of test required.*—This should be specifically stated. It has been our frequent experience to get, for instance, samples of urine for “full examination.” One does not know in such cases where to stop, especially if no history is given, and to do all that can be done would be a great labour and big expense, generally with no particular object. This is, of course, only one example of many difficulties that the pathologist experiences in interpreting a practitioner's wishes.

6. *Short history of case.*—In the case of specimens for Wassermann tests the following particulars should be given :

- (1) *Date of primary infection.*

- (2) *Treatment given :*

- (a) Mercurial (duration of, and date of last dose).

- (b) Salvarsan (number of doses and date of the last).

- (3) *Previous tests, with dates and results.*

V

BLOOD COUNTS

THE taking of blood for blood counts requires a little practice, and therefore it is best to ask the pathologist to do this himself. Where this is impossible we have found the following methods satisfactory. Laboratories which use other methods will doubtless send full instructions with the apparatus. The term "complete blood count" includes *all* of the following three tests:

I. Estimation of Hæmoglobin

Instructions for use of apparatus for hæmoglobin (see Diagram I).

1. Remove rubber band (not shown in this, but in Diagram II) from the pipette and attach the rubber sucker.

2. Stand up the small bottle in its stand and remove cork, *taking great care not to spill the slightest drop of fluid*, as this is a measured quantity (2 c.c.).

3. Massage thoroughly with a towel the lobe of the ear until it becomes congested. Stab smartly with the surgical needle so that the blood flows freely. Alternatively, the blood can be taken from the finger as described on p. 65.

4. Bring the point of the pipette in contact with the drop of blood, and allow it to run up to the mark (10 cm.), using gentle suction if necessary. Should the blood go a little over the mark, it can be brought back to the mark by tapping the point of the pipette on the towel until the right level is reached.

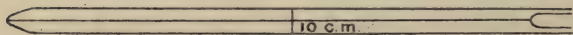
5. Carefully wipe the outside of the tip of the pipette

free from blood. *This is important.* To do this hold the pipette horizontally to prevent the escape of any blood. (We have sometimes received specimens yielding results of 180 per cent. hæmoglobin, and this absurd result is due to the fact that the blood adhering to the outside of the pipette has not been wiped away, and consequently too much blood has been added to the distilled water.)

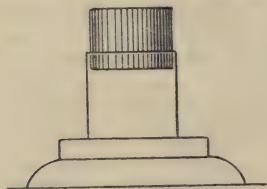
6. Put the tip of the pipette into the little bottle of



RUBBER SUCKER WITH MOUTHPIECE.



MEASURING PIPETTE FOR BLOOD.



GLASS POT (IN STAND) CONTAINING 2 C.C. OF WATER.

DIAGRAM I

distilled water, and blow the blood into the water. *Very gently* suck up and blow out two or three times so as to get all the blood adherent to the inside of the capillary pipette into the fluid.

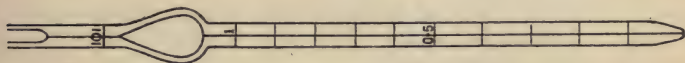
7. Cork the bottle firmly and shake the contents to thoroughly mix.

Note.—Do not use any soap or antiseptic for cleaning the ear before making the puncture. If the ear needs cleaning at all, use plain water and dry thoroughly before stabbing. It is *most* essential that the blood be drawn very accurately to the mark indicated.

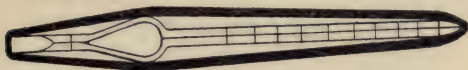
II. Enumeration of Red and White Cells

(See Diagram II)

1. After removing rubber band and attaching the "sucker" to the pipette (see Diagrams I and II), massage the lobe of the ear between thumb and forefinger with a clean towel. Then prick the edge of the lobe smartly with a surgical needle so that the blood flows freely without further manipulation. *Gentle* squeezing is permissible, but no great force may be used.
2. Wipe away the first drop of blood that issues.



DILUTING PIPETTE FOR RED CORPUSCLES.



THE SAME WITH RUBBER BAND IN POSITION.

DIAGRAM II

3. Bring the point of the long limb of the pipette in contact with the blood and allow it to run in, using gentle suction if necessary, until the blood reaches the mark 1 (or 0.5, *vide infra*) below the bulb (see diagram).
 4. Wipe the point of the pipette dry.
 5. Hold the pipette vertically, and suck up the diluting fluid (*vide infra*) until the mixture of blood and fluid reaches the mark 101 above the bulb (see diagram).
 6. Immediately rotate the pipette rapidly to and fro so as to thoroughly mix the contents.
 7. Replace the rubber band on pipette and see that it is secure; otherwise the mixture will be lost in transit.
- Roughly speaking, the mark 1 should always be used unless polycythæmia, congenital heart, etc., is suspected,

in which case it is better to use the 0.5 mark, *but always tell the pathologist which mark was used.*

Many different diluting fluids are used. We prefer a solution of sodium sulphate of specific gravity 1.026 and coloured with methylene blue to match Fehling's solution.

Note.—Do not use any soap or antiseptic for cleaning the ear before making the puncture. If the ear needs cleaning at all, use plain water and dry thoroughly before stabbing. It is *most* essential that the blood be drawn very accurately to the mark indicated, and a note should be enclosed stating to which mark on the pipette the blood was drawn.

The enumeration of both red and white cells can be done as above, but a more accurate white cell count is obtained by using a separate pipette—one which gives a dilution of the blood of 1 in 10. This pipette will be marked 11 above the bulb instead of 101, but is used in the same way as described above except that a special diluting fluid containing acetic acid is required.

III. Instructions for making Blood Films, Pus Films, etc.

1. Have ready four slides.
2. Lay out three of the slides on a firm white basis.
3. Massage the lobe of the ear between thumb and forefinger with a clean towel. Then prick the edge of the lobe smartly with a surgical needle so that the blood flows freely without further manipulation (gentle squeezing is permissible, but no great force may be used).
4. Wipe away the first drop of blood.
5. Bring the short edge of a slide in contact with the drop of blood (which should be about the size of a match head).
6. Bring the blooded end of the slide in contact with the surface of one of the others at an angle of about 30 degrees, and by means of two or three sideways movements of the spreading slide run the blood along the whole breadth of both where they are in apposition,

then draw the blood rather slowly along the lower slide by *pushing* the spreading slide, which should be resting on the finger, and so exerting no pressure beyond the weight of the slide.

7. Spread three films thus and allow them to dry in the air. When quite dry they are ready for transmission.

The time taken in the actual spread of a film should be 5 to 7 seconds. Other things being equal, the shorter the time the thicker the film.

For spreading films it is better to have the edge of the spreading slide narrower than the slides on which the films are to be spread. This is usually obtained by breaking off the corners of a slide. Such a slide should be provided by the laboratory with the outfit.

The following points should be noted in making blood films for examination for the **malarial parasite** :

No quinine should have been administered to the patient for at least forty-eight hours before the specimen is taken.

The blood films should be made if possible at a period four hours before or after the maximum temperature is usually reached.

PUS for examination for the gonococcus or other organisms is best transmitted on slides spread in the same way as above, except that slightly more pressure should be exerted and the rate of spreading be even slower. If pus has to be spread from a swab, this should be *dabbed* on the slide and not rubbed on it.

DIRECTIONS FOR TAKING BLOOD FOR SEROLOGICAL TESTS, *e.g.* WASSERMANN, WIDAL, ETC.

I. By Venipuncture

Note.—The following is a description of the apparatus we use. Other forms are on the same principle, though perhaps modified in detail.

1. Clean up the arm at bend of elbow with alcohol and ether, or apply iodine.

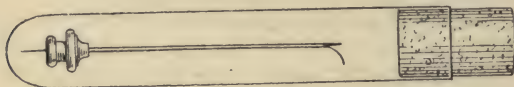
2. Put on a tourniquet above the elbow to constrict the veins, but not the arteries.

3. Attach the rubber tube to end of needle and remove wire from needle (see Diagram III).

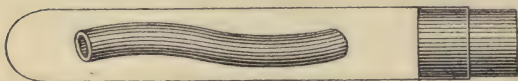
4. Fix vein and skin by placing left thumb on vein about two inches below site selected for the puncture.

5. Insert needle into vein in the direction of the blood-stream, with the eye of needle towards operator. When in the vein rotate needle a half turn. Collect blood in *same* tube as the needle was in (see note).

6. When the tube is half filled, loosen tourniquet and withdraw needle. Seal skin puncture with collodion.



STERILE TUBE CONTAINING HYPODERMIC NEEDLE.



STERILE TUBE CONTAINING RUBBER TUBING FOR ATTACHMENT TO HYPODERMIC NEEDLE.

DIAGRAM III.

7. Set aside to clot, and two hours later loosen clot from side of tube.

8. Allow it to stand in upright position for six to twelve hours.

9. Draw off the clear serum from the blood (as free of corpuscles as possible) with sterile hypodermic syringe and put serum into the other tube with rubber bung.

10. Replace bung and dispatch complete apparatus to laboratory.

Note.—If blood is sent by post without separating serum from clot, it is very apt to become hæmolysed and useless for Wassermann test.

If to be returned by hand, the blood may be collected direct into the tube with rubber stopper, and Instructions 7 to 10 ignored.

II. In Capsules

(See Diagram IV)

This *alternative* method should only be employed when the above is impossible.

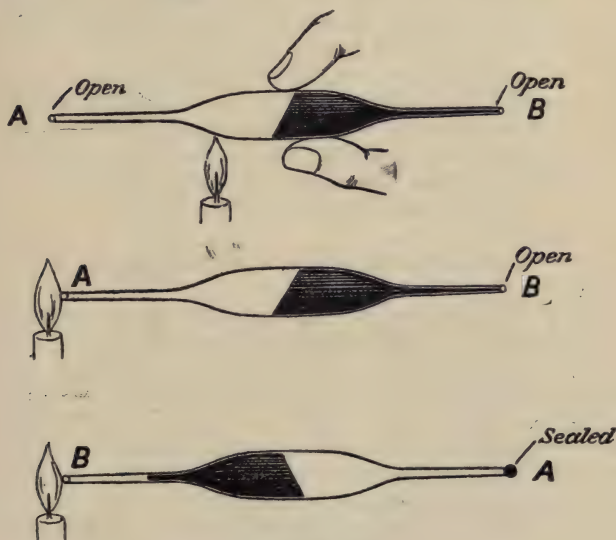


DIAGRAM IV.

1. Cut off *both* ends of the pipette with a small file, leaving as long " necks " as possible (see Diagram IV).

2. Steep the patient's thumb (or finger) in hot water for a few minutes, and then thoroughly dry it.

3. Wind a " tourniquet " (a piece of narrow rubber tubing is admirable for the purpose, but a handkerchief or bandage will do) fairly tightly round the thumb from its base upwards so as to congest the ball of the thumb.

4. Stab smartly the ball of the thumb with a surgical needle, and hold the end of the pipette to the puncture. The blood will flow in by capillary attraction, and the pipette should be held as nearly as possible horizontal, as, if it is tilted down too much, the blood may run to the other end and the capillary action cease. If sufficient blood is not obtained at once, unwind the tourniquet, wait a few seconds, and then rewind. This process can be repeated several times until the pipette is full. The important thing is to stab hard, especially if skin is thick.

5. Seal both ends of the pipette with a spirit lamp or gas jet (using a small flame) as follows: First warm the neck at the end which contains no blood (see Diagram IV), and when the glass is warm seal off the open end in the edge of the flame and allow to cool. The cooling air will draw the blood away from the other end, which can then be sealed off without heating the blood. *Take care not to burn the blood.*

6. Post off *at once*.

Note.—Blood may be taken from lobe of ear if preferred (see blood films, p. 62).

The pipette as used by the majority of laboratories holds about $\frac{1}{2}$ c.c., and must be at least three parts full of blood. For Widal, etc., one is just sufficient, and twice this quantity (*i.e.* two pipettes) should be collected for Wassermann. This method is satisfactory for Widal's, etc., although it is of course better to send a larger quantity, but for Wassermann's it should only be used when venupuncture is impossible.

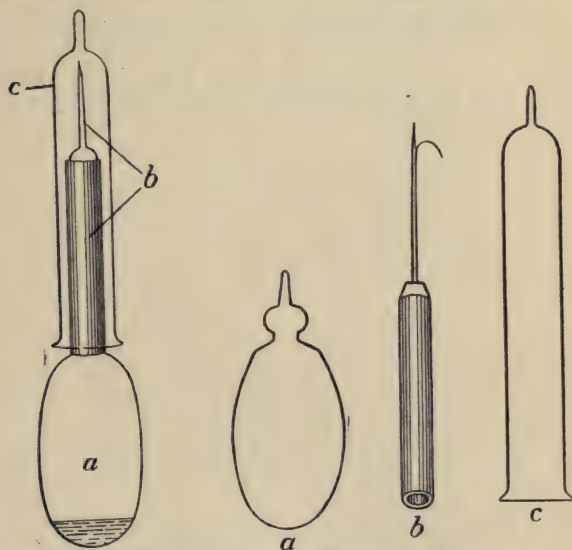
Re Wassermann Test.—This test takes one day to perform, but it is not reasonable to always expect a report the following day, because Wassermann's are necessarily done in batches, and consequently may not be done every day.

COLLECTION OF BLOOD FOR BACTERIOLOGICAL EXAMINATION, SEPTICÆMIA, ETC.

We strongly urge that, whenever possible, the pathologist should be called in to make his own cultures direct

from the venous blood, but the method described is useful when bacteriological examination is required, and it is impossible for the pathologist to attend.

The apparatus (see Diagram V) consists of (*a*) an exhausted and sealed glass phial, containing a little 1 per cent. sodium citrate solution; (*b*) a piece of pressure



APPARATUS COMPLETE. SEPARATE PARTS OF APPARATUS.

DIAGRAM V.

tubing attached to a hypodermic needle, enclosed in a sterile tube (*c*).

The "Hyposol" supplied by Messrs. Allen & Hanbury is a suitable apparatus.

(*a*) Remove the sterile glass tube from over the needle and rubber tubing.

(*b*) Then remove the wire from the needle by sterile forceps (sterilize by heating in spirit or gas flame—not by antiseptics).

(c) Proceed as for venupuncture, p. 63.

(d) When quite sure that the needle is in the lumen of the vein, break off the tip of the phial inside the rubber tubing by exercising pressure between the finger and thumb. The blood will then be drawn slowly into the phial.

(e) When sufficient blood has been obtained, withdraw the needle from the vein, remove the rubber tubing, and seal off the point of the phial in a gas or spirit flame. It may be necessary to just shake the blood down into the bulb if any remains in the neck.

VI

EXAMINATION FOR SPIROCHÆTES

I. FROM SORE.

The sore should be first cleansed and then a little rectified spirit applied for one minute. This is then wiped away. Serum can then be expressed from the sore and collected in a capillary pipette (*vide infra*). Usually enough serum will be obtained to send in this way, but if not make smears on slides and allow to dry (see p. 62).

2. **From** material obtained by **gland puncture**. (This method is also used in examination for trypanosomes, *Bacillus lepræ*, etc.).

The skin over the gland should be cleansed and a puncture with a sterile hypodermic syringe made into the gland. The point of the needle is stirred in the gland substance and strong suction exerted. The drop or two of fluid is then expressed into a capillary pipette, if sufficient. If not, spread smears as for blood films (see p. 62).

It is best to send the patient to the laboratory for direct examination for spirochætes. The fluid obtained as above should be allowed to run into a capillary pipette (not a capsule); this, having been sealed as described for capsule on p. 65, should be sent to the laboratory as rapidly as possible.

The **capillary pipette** is simply a straight piece of fine glass tubing, *i.e.* similar to the capsule (Diagram IV) but without the bulbous portion.

VII

COLLECTION OF URINE

I. For Microscopical Examination for Casts, Blood, Pus, Epithelium, etc.

THIS *can* be done on a twenty-four hours specimen, but often the latter gets grossly contaminated by bacteria, which obscure the microscopical picture. It is therefore better, in our opinion, to obtain a mixed night and morning specimen as follows :

The urine to be tested should be passed directly into a sterile bottle, and this must be half filled by urine passed last thing at night, and then filled up with the first morning urine.

II. For Chemical Examination

For this a twenty-four hours specimen is necessary, and if practicable the whole twenty-four hours collection should be sent to the laboratory, where it can be accurately measured and mixed. If this is impossible the following points must be observed :

Six ounces is sufficient for most tests, and it should be accompanied by a statement of the total quantity passed in twenty-four hours. The patient should be instructed to pass the whole day's urine into one *clean* vessel, previously scalded out with hot water. In instructing the patient, be precise as to the times for starting and stopping the collection. Suppose, for instance, he starts with the first morning urine on rising, then he must *not* include in the twenty-four hours collection the urine passed on rising the following morning. This is frequently done, and, of course, gives fallacious figures. When the twenty-four hours collection is completed,

the urine must be *thoroughly* mixed, because sedimentation will have occurred. In our opinion there is only one way of ensuring proper mixture—*viz.*, to pour the urine from one vessel to another and back again twice over. We have repeatedly found that samples containing a considerable amount of albumen yield deposits in which are no pathological elements. On inquiry it has been found that this is simply due to the fact that the urine has not been thoroughly mixed. From the mixed collection fill a 6-oz. bottle, and state on the label the total quantity passed in the twenty-four hours, and send direct to the laboratory.

III. For Bacteriological Examination

Catheter specimens are always preferable except when it is suspected that infection is confined to the (male) urethra. *In females* it is necessary to thoroughly cleanse the external genitals with aseptic (not antiseptic) precautions and to *irrigate the urethra*; or the excellent glass catheter guide devised by Dr. G. L. Eastes may be used. This consists of a small glass tube with a funnel-shaped end. The narrow end is passed into the urethral orifice and the catheter passed through the tube, thus avoiding any contact with the vulva.

In the male, as a rule, catheter specimens are not an absolute essential, provided that the meatus is very thoroughly cleansed with alcohol followed by sterilized water. The urine is then passed direct into a sterilized bottle.

Be quite sure no trace of antiseptic gets into the specimen. Therefore, in catheterizing, use no antiseptic for the catheter.

VIII

COLLECTION OF SPUTUM

For Bacteriological Examination, etc.

AFTER brushing the teeth thoroughly, the mouth should be rinsed out four times with cooled boiled water. The patient should be instructed to then bring up, by deep coughing, sputum from the lungs and spit direct into a sterile bottle.

IX

COLLECTION OF FÆCES

I. For Bacteriological Examination

ONLY a small quantity is necessary, and if blood and mucus are present select these portions. The motion should be passed into a vessel which has been sterilized by scalding or flaming out with methylated spirit. With a sterilized spoon transfer a portion to a sterilized bottle. Most laboratories supply a small sterilized bottle with a spatula attached to the cork.

II. For Chemical and Microscopical Examination

The same procedure as above will suffice in most cases, but sterilization is not absolutely essential. For certain elaborate chemical tests, and in searching for worms and ova, larger quantities are required, and a whole motion can be sent in a clean jam-jar or tin. Except in special circumstances the natural motion unassisted by purging should be sent.

In cases where the digestive power of the intestinal juices is in question, the patient should be put on the following diet for at least three days before collecting the sample, and a good plan is to give a charcoal powder when starting the diet, and wait until this appears in the fæces before collecting the sample.

Diet.—Breakfast, 7 a.m., bowl of oatmeal gruel (40 grms. oatmeal, 10 grms. butter, 200 c.c. milk, 300 c.c. water). Also one very soft-boiled egg (one minute), and 50 grms. zwieback (or rusks). In the forenoon 500 c.c. of milk.

For dinner, 2 o'clock, chopped beef cooked *very lightly* (125 grms. with 20 grms. butter poured over it). Also a potato *purée* (200 grms. mashed potato, 50 grms. milk, 10 grms. butter). Also $\frac{1}{2}$ litre of milk and 50 grms. zwieback (or rusks).

For supper, 7 o'clock, the same articles as for breakfast.

This detailed diet may be varied to suit circumstances by interchanging meals. Furthermore, the milk may be taken in the form of tea or cocoa, or cooked with the other food. Even a small amount of wine may be permitted. The diet taken, however, should absolutely conform to the following requirements :

(1) The taking of $\frac{1}{4}$ lb. chopped beef, a portion of which should be half raw ; (2) the milk taken should amount to about a quart ; (3) about 4 ozs. of bread or toast, and from 4 to 8 ozs. of potato *purée* should be eaten daily.

The detailed diet contains about 110 grms. albumen, 105 grms. fat, and 200 grms. carbohydrates, with a fuel value of 2,247 calories.

(The above diet is copied from Stitt's *Practical Bacteriology, Bloodwork, and Parasitology.*)

X

DIRECTIONS FOR TRANSMITTING "TISSUES" TO THE LABORATORY

1. *For Bacteriological Examination or Animal Inoculation for Tubercle Bacilli, etc.*—The tissue should be removed under strict aseptic (not antiseptic) precautions, wrapped in sterile lint soaked in sterile normal saline solution, and placed in a sterile bottle with rubber bung. It should reach the pathologist *as soon as possible*. If at a distance passenger train is best, and a telegram should be sent to pathologist to meet it.

2. *For Histological Examination: Tumours, etc.*—It is best to send the whole tumour if possible, but in the case of large tumours this may be impracticable. In that case cut out representative pieces of tissue and place in clean bottle with *wide* mouth and rubber bung, and fill the bottle with 50 per cent. spirit (*i.e.* Spr. Vin. Rect. and water, partes equales) (see note below). *Curettings* are of course treated in the same way, but remember that it is easier to pick out the pieces of tissue from the accompanying blood at the time of the curettage. The tissue should, therefore, be separated and put in the 50 per cent. spirit as free as possible from blood. Tissue should be placed in the spirit as fresh as possible, *i.e.* immediately after excision. Do *not* send in *strong* formalin.

3. *Specimens for mounting as Museum Preparations.*—These should be placed in Kaiserling's solution :

Potassium Acetate	30 grms.
Potassium Nitrate	15 "
Water	1,000 c.c.
Formalin	150 c.c.

If this is unattainable, 10 per cent. formalin can be used, but is not so good.

Note.—We prefer tissues sent in 50 per cent. spirit unless there is no urgency for a report, or unless “demonstration” sections are required. In that event we think Zenker’s fluid is the best. Others like 10 per cent. Formalin as a routine fixative. If either of these fluids is used, a few days’ delay must be allowed for the section and report.

XI

DIRECTIONS FOR TEST MEALS

A SPOONFUL of any jam containing pips should be given at night. The following morning give two small pieces of toast and 400 c.c (about $\frac{3}{4}$ pint) of water. Leave this for one hour, and then withdraw by stomach tube or pump. *No fluid of any kind should be used to start syphonage.*

The stomach tube is more easily passed if chilled in ice water. No lubricant may be used.

XII

DIRECTIONS FOR TAKING NASAL, NASOPHARYNGEAL, AND THROAT SWABBINGS

No detailed instructions as to how to take swabbings from throat and nose are necessary. The points to remember are—

1. Be sure that the swab does not touch anything but the ulcer or mucous membrane which it is desired to swab.

2. No antiseptic treatment should be allowed for twelve hours previous to taking the swab, and in this

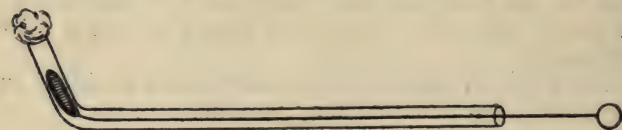


DIAGRAM VI.—WEST'S SWAB.

connection remember that the patient may have been taking some antiseptic on his own responsibility.

3. Always use *firm* pressure on tonsils, posterior pharyngeal wall, etc.

4. Ensure that the swab reaches the laboratory as quickly as possible.

NASO-PHARYNGEAL SWABBINGS may be taken by means of—

1. West's swab (see Diagram VI) as follows :

- (1) Remove the cotton-wool plug from the end of the bent glass tube, and then see that the wire rod works freely by pushing it out and drawing it in again.

(2) Pass the bent end of glass tube back over the tongue with bent end horizontal.

(3) Instruct patient to say "Ah!" Turn the bent end upwards and push the wire handle so that the swab

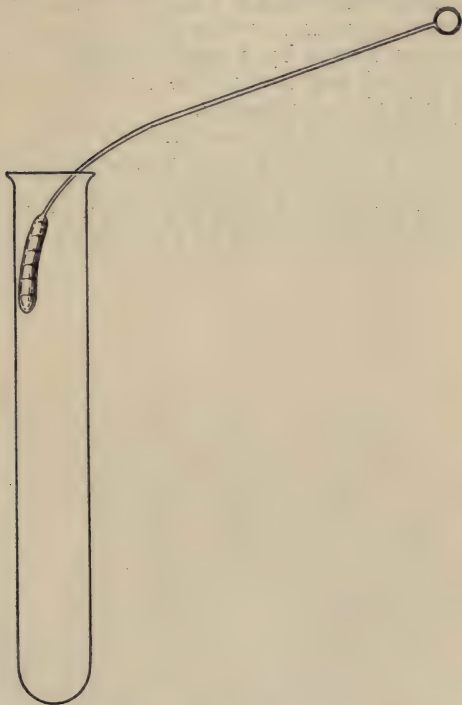


DIAGRAM VII.—SHOWING METHOD OF BENDING "DIPHTHERIA" SWAB.

is extruded and passes behind the soft palate into the naso-pharynx.

(4) Withdraw swab into glass tube *before* taking the tube out of the mouth.

(5) Flame the wool plug and insert into the end of the tube.

2. An ordinary diphtheria swab. This can be used as follows (see Diagram VII; also p. 79):

(1) Withdraw swab to about $1\frac{1}{2}$ inches from its end. Then bend it at this point to an angle of about 45 degrees, using the edge of the tube as a lever; or if strong sterile forceps are handy these can be used to bend the swab.

(2) Depress tongue by a tongue depressor, pass the swab up behind the soft palate and press firmly on posterior wall of naso-pharynx.

(3) Withdraw swab and bend it back straight enough to replace in tube. In passing and withdrawing swab avoid contamination by saliva.

We prefer the latter method to a West's swab, because more pressure can be exerted on "Luschka's tonsil," etc.

XIII

EXAMINATION OF WATER

IN testing for potability we recommend that both chemical and bacteriological examination be employed

METHOD OF COLLECTION AND TRANSMISSION

I. For Bacteriological Examination

Special apparatus is necessary to keep the water ice-cold during transmission to the laboratory. This apparatus can as a rule be obtained from the laboratory. It is useless to send water in any other way.

The collecting vessel must be sterile. The amount sent should be at least 4 ozs. In collecting, care must be taken not to contaminate the stopper or lip of the bottle—do not touch these with the fingers. Dispatch immediately to the laboratory by passenger train, and advise the pathologist as to time of arrival.

To collect from—

1. *A tap*.—Allow the water to run for at least three minutes before taking a sample.

2. *A pond or river*.—After removing stopper invert the bottle and plunge as deeply in the water as possible, then turn the bottle mouth upwards and allow to fill.

3. *A well*.—Take the sample in the same way as in (2) from the well bucket.

A special apparatus is obtainable for taking samples from a depth.

Supply particulars as for chemical analysis, *vide infra*.

II. For Chemical Examination

For this examination the collecting vessel need not be sterile, but thorough cleanliness should be observed.

The quantity sent should be at least 2 litres, and a Winchester quart bottle is a suitable vessel. The collection should be made as for the bacteriological test.

The following particulars should be supplied :

Name and address.

Date of collection.

Exact place from which sample is taken.

If from a tap, state whether drawn from cistern or directly from main.

Source (well, river, spring, stream, or public supply).

If from a well :

1. Depth.
2. Whether bricks are set in cement, or are cement lined, or puddled behind.
3. Nature of stratum from which derived.
4. Proximity to drains, cesspools, etc.
5. Proximity to sea or tidal river.
6. Is the water affected in appearance, odour, or taste after heavy rain ?

If the water contains visible sediment, state whether it is filtered or allowed to sediment before use.

XIV

DIRECTIONS FOR SENDING SAMPLES OF MILK FOR ANALYSIS

1. *For chemical tests* as to quality. About 6 ozs. should be sent in a *clean* bottle, and the sample should be as fresh as possible. No preservative should be added.

2. *For microscopical (pus, blood, dirt, etc.) and bacteriological tests—i.e.,* tests directed to find out whether the milk comes from healthy udders. In general the same directions apply as for samples of water. The quantity of milk need not exceed 2 ozs. The vessel must be sterilized and the sample sent on ice.

XV

THERAPEUTIC INOCULATIONS

WE propose here to state very briefly the dosage and method of administration of the various vaccines and sera in common use, and to indicate roughly the broad general principles without going into any detailed theoretical consideration of the subject, for which special works should be consulted.

VACCINES

Definition.—A vaccine is a suspension of killed bacteria in physiological salt solution. Attenuated living bacteria are sometimes used, but these have not met with general approval, and are not without danger.

Mode of Preparation.—The bacteria are isolated from the lesion, and grown in pure culture in sufficiently large quantity—usually on solid media—and are then washed off in normal saline, killed by heat or antiseptic (or both), and standardized by estimating the number of bacteria per c.c. of the suspension, and diluting to the required strength. As little heat as necessary should be used in the killing of the bacteria, and some people rely entirely on antiseptics (*e.g.* 0.5 per cent. phenol) for the purpose. Another point of importance is that the vaccine should be made from a generation of the bacterium as little removed from the human body as possible. In the case of pure cultures it is sometimes possible to make the vaccine from the first culture, but usually it will be the second or third sub-culture that is used, owing to the necessity of securing

purity and bulk of growth. This is especially the case in mixed infections. Some people make up mixed vaccines without separating the various kinds of microbes, but this is a practice of which we do not approve, because it is impossible to apportion the respective doses. We, therefore, invariably isolate all the infecting microbes in pure culture and make the vaccines separately, and then mix in their proper proportions; obviously a more troublesome and lengthier process, but in our opinion much more reliable.

Mode of Action.—The therapeutic action of a vaccine has been briefly summarized as the exploitation of the healthy tissues for the benefit of the unhealthy tissues. The theory (substantiated by experiment) is that injection of the bacterial substance into the tissues stimulates the formation of antibacterial bodies which, being distributed by the circulation, are brought to bear on the microbes at the site of infection. All that the vaccine does is to raise the immunizing power (epiphyllaxis) of the body fluids, and obviously this is of little avail if these fluids for any reason do not gain access to the infecting bacteria. It follows, therefore, that local measures are frequently necessary to ensure a free flow of lymph through the affected part (*e.g.* incision, scraping, fomentation, hypertonic salt treatment, etc.).

Keeping Properties.—Our opinion is that the age of a vaccine is important, and that its efficacy deteriorates with keeping. We do not, therefore, care to use a vaccine for longer than six months after date of preparation.

Specificity.—Generally, in the treatment of an infection, it may be stated that the actual organism causing the infection should be used—*autogenous vaccine*. In the case of certain organisms, however, *stock vaccines* (*i.e.* vaccines made from other similar cases) may be used with good effect, but here we think a word of caution is necessary as regards the mode of preparation and selection of the stock vaccine. We have already pointed out that the vaccine should be made from a recent

generation, and that it should not be too old. These two desiderata can only be complied with if the stock vaccine (which should include a number of strains of the particular microbe) is made by mixing various recently prepared autogenous (for other cases) vaccines. In some instances the alternative method of making the stock vaccine from old laboratory cultures is necessary owing to lack of sufficient recent cases to draw upon. The method recommended, too, has the disadvantage that it can only be carried out by laboratories having a large autogenous vaccine practice.

At one time it used to be thought that immunization was always absolutely specific—that staphylococcal vaccine, for instance, *only* protected against staphylococcal infections. It has now, however, been shown conclusively by Wright and others that this is not the case, and that vaccines will sometimes produce a degree of collateral or non-specific immunity. This undoubted fact must, however, not be considered to upset the usual practice of choosing the specific bacterium, because in this way we should get a better response than by using a different bacterium.

Uses—I. *Therapeutic*.—Vaccines may be used for any bacterial disease in which the microbe can be isolated and the vaccine made. Classes of case which do not so readily respond are those in which there is generalized infection, long-standing infections, etc.—*i.e.*, cases in which the body may be supposed to have made its maximum epiphylactic response.

2. *Prophylactic*.—For the prevention of (1) epidemic disease, *e.g.* typhoid, dysentery, cholera, etc. (2) “Personal” infections—*i.e.*, infections, not of an epidemic character, to which the patient has a special susceptibility (*e.g.* boils, carbuncles, bronchitis, asthma, nasal catarrh, etc.).

Interval between Doses.—This is important, and frequently harm is done by not allowing a long enough interval. It should be realized that vaccine may produce a “negative phase” immediately following injection and a positive phase later. The object, therefore,

is to so regulate the dosage that each dose is given at the height of the positive phase produced by the previous dose. Generally speaking, seven days is a suitable and convenient interval unless very small or very large doses are being used. In prophylactic injections large doses are used, and the interval should be at least ten days.

Method of Administration.—Vaccine may be supplied in one of two forms: (a) in bulk in rubber-capped bottles; (b) in hermetically sealed glass ampoules, each containing one dose suspended in approximately 1 c.c. (18 minims) of fluid.

In the latter case thoroughly shake the ampoule to mix the contents, then notch the neck of the ampoule with a cutting-file, break off and extract the contents with a hypodermic syringe. The dose will be marked on the ampoule in millions (of bacteria). If it be desired to give a smaller dose than that marked on the bulb, a proportional amount ($\frac{1}{2}$, $\frac{3}{4}$, etc.) can be taken up, but this is best done as follows: Say the dose on the bulb is 100 millions, and it is desired to give 75 millions, first suck out the *whole* contents into the syringe and note how much they measure—let us say 20 minims. Then discard 5 minims and inject the rest (15 minims) into the patient. It is necessary to measure the contents, as they are seldom exactly 1 c.c., though the stated dosage in millions is accurate.

The rubber-capped bottles are usually coated over with paraffin or similar substance. The dosage will be in millions of bacteria per c.c., and the label should state the initial dose recommended and the maximum dose thus:

AUTOGENOUS STAPHYLOCOCCUS VACCINE

For T. Jones, patient of Dr. Andrews
[1 c.c. (18 minims) contains 1,000 millions]

Initial dose = 100 millions

Maximum dose = 1,000 millions

Prepared January 1st, 1920. Shake the
bottle before use. *Not to be used after*
July 1st, 1920.

In order to get your proposed dose out of the bottle proceed as follows :

Thoroughly shake the bottle (bacteria settle slowly on standing). Then sterilize the top of the rubber cap with pure lysol or carbolic acid, wiping away excess after it has been applied a few minutes. Invert the bottle and plunge the hypodermic needle through the rubber cap. Withdraw the requisite amount of fluid and inject into patient. The puncture in the cap may be relied on to seal itself, but it is an extra safeguard to remelt the paraffin over the puncture by applying a hot rod or match-end to the tiny hole.

The injection is given into the subcutaneous tissues with an ordinary hypodermic syringe, which should, of course, be previously boiled. A fresh site for inoculation should be as far as possible selected for each puncture where many doses are to be given. The upper and lower arms, thighs, subclavicular, interscapular, or hypogastric regions are suitable sites. Vaccines are best given in the afternoon or evening when the patient is able to rest, but usually this is not important.

Having injected the dose, exercise gentle massage of the "lump" for a minute or two to distribute it, and as an extra precaution a drop of collodion may be applied to the puncture.

Effects.—Reaction may occur, and may be either (1) *General*—headache, malaise, fever, etc. If this occurs it is an indication of too large a dose. The degree of general reaction is important. If only slight, do not give another dose for ten days, and do not increase the dose. If severe, give fourteen days' interval and reduce the dose to a half. (2) *Local reaction*, i.e. redness, pain, swelling, etc., at the site of inoculation. Unless severe or accompanied by general reaction, this need not interfere with the course of vaccination; otherwise directions as for general reaction.

The following is a list of adult doses we recommend for the various bacteria in common use. For *children* up to five years we give one quarter of the dose; from

five to ten years, half the dose ; from ten to fifteen years, three-quarters of the dose :

	Initial dose.	Increasing by.	Maximum dose.
	Millions.	Millions.	Millions.
Staphylococcus	100	100	2,000
Streptococcus	5	5	100
B. coli, Friedländer, B. proteus, etc.	10	10 to 100	1,000
B. pyocyaneus	5	5 " 10	100
Actinomycosis	2½	2½ " 5	25
Pneumococcus	2½	2½ " 5	50
Gonococcus	5	5 " 20	500
Micrococcus catarrhalis . .	10	10 " 50	500
Acne bacillus	10	10	100
Diphtheroid bacilli, such as Klebs-Loeffler bacilli, Hofmann bacilli, septus, etc.	5	5 to 10	100
B. influenzae	5	5 " 10	100
Typhoid (prophylactic) 1,000	1st dose)		
2,000	(2nd dose)		
500	(1st dose)	1,000 (2nd dose)	
T.A.B. { Typhoid.			
Paratyphoid A. 250	" "	500 " "	
Paratyphoid B. 250	" "	500 " "	
Cholera	1,000	" "	2,000 " "

DETOXICATED VACCINES

Recently a method of removing the toxin from bacteria has been described, and it is claimed that, in consequence of this, much larger doses can be given and a greater immunity produced. Roughly speaking, the method of detoxicating is to dissolve the bacterial bodies in an alkali and reprecipitate by an acid. Only the bacterial body substance is precipitated, the endotoxin remaining in solution. This is removed by centrifugalization. It is too early yet to make any definite statement as to whether these vaccines are better than simple vaccines, but certain it is that very much larger doses may be given. For most organisms the body substance equivalent to about 500 millions is a suitable initial dose. Detoxicated vaccines may, of course, be either "stock" or autogenous, and the same rules apply to their administration as to other vaccines.

SENSITIZED VACCINES

These are vaccines in which the bacteria have previously been treated with their specific antiserum. It is claimed that larger doses can be given than with non-sensitized vaccines. They have not met with general acceptance by bacteriologists, and in truth there seems to be no good reason for their employment.

IMMUNE SERA

The theory underlying the use of antisera is entirely different from that of vaccines. In the case of sera we are injecting the actual antitoxic or antibacterial bodies which have been elaborated in the body of a suitable animal by the use of vaccines or toxins in that animal. Thus by using a serum we propose to inject the antibodies themselves; by using a vaccine we propose to stimulate the tissues to produce those antibodies themselves. It follows that the two methods do not contra-indicate one another, and both may be used simultaneously. It also follows that, within practical limits, the larger the dose of serum that can be given the greater should the effect be, and there can be little doubt that failure of sera is sometimes due to the use of too small a dose. Generally speaking, too, the response will be more rapid if intravenous injection is used rather than subcutaneous. As a rule 20 c.c. should be regarded as a minimum dose of an antibacterial (or anti-endotoxic) serum. In the case of antitoxic (anti-exotoxic) sera the dosage is reckoned in units of antitoxin (the unit being the amount necessary to neutralize 100 minimum lethal doses of toxin for a guinea-pig of 250 grms. weight).

Anaphylaxis.—In giving sera remember the possibility of anaphylaxis (*i.e.* hypersensitiveness to foreign proteid). In the severe cases this is evidenced by the onset of symptoms within a few minutes of the injection. Respiration becomes laboured, with muscular weakness,

paroxysmal cough, and cyanosis, and death may occur in convulsions or coma. Most cases recover, and all degrees of severity of symptoms may be met with. This hypersensitiveness is the direct result of an injection of proteid, and takes about fourteen days to develop. Hence one can safely continue to use sera daily provided the first dose produces no ill-effect, and no interval of more than six days (for safety) is allowed between the doses. Before giving the "first" dose always, therefore, make *sure* that the patient has not had serum of *any* kind injected *more than six days* previously. If such serum has been given the individual must be regarded as potentially anaphylactic, and the following precaution must be taken: Give only $\frac{1}{2}$ c.c. of the serum subcutaneously, and wait six hours. Then give the full dose, if no symptoms have supervened in the meantime. The small preliminary dose will desensitize the patient.

Appended is a list of doses of the commoner sera :

DOSES

Antistreptococcal serum	. 30 c.c. (may be repeated daily).
Antistaphylococcal serum	. 30 c.c. " " " "
Antigonococcal serum	. 30 c.c. " " " "
Antipneumococcal serum	. 20 c.c. (may be increased to "30 and given daily).
Antimeningococcal serum	. 30 c.c. intrathecally or intravenously.
Antidysenteric serum	. 30 c.c. twice or more times daily according to severity of case.
Antiplague serum	. 50 - 100 c.c. (repeat if necessary).
Antivenom and Antiplague	. Give very large doses, 50-800 c.c.
Diphtheria antitoxin	. 4,000 to 20,000 units according to severity of case.
Tetanus antitoxin	. For treatment give large doses intravenously, intramuscularly, subcutaneously, and intrathecally (all may be given together), about 20,000 units. Repeat daily till symptoms disappear. For Prophylaxis give 500 units subcutaneously.

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